Data visualisation of participation in local planning

Lancaster University

Infrastructures for Participation — Institutional and Technical Considerations for New Forms of Participation in Urban Development

by Sebastian Daniel Weise, BBA, MRes

Library ID 30345045

for the degree of a Doctor of Philosophy in Digital Innovation

Lancaster University

September 2015

Supervisors:

Professor Mike Chiasson (UBC),

Professor Paul Coulton (Lancaster University)

THESIS ABSTRACT

The proliferation of Internet-connected mobile and situated digital devices combined with the ubiquity of online collaboration and interaction exposes the need to review the ownership models for data and digital infrastructures that increasingly perform as politicised resources in everyday life. Viewing geography as an important aspect to the socio-cultural context within which potential new forms of 'bottom-up' online participation are performed, this thesis analyses the *practices* surrounding the ownership of, as well as the participation in urban planning through the various information communication technologies (ICTs) encountered in decisions affecting the material context of cities.

In two ethnographic studies of information systems in municipal planning, technology-supported citizen participation is analysed. First, participation records for 597 citizens in a three-year planning process in Lancaster (UK) are used to reconstruct the *geographic* patterns of participation in relation to places. Then, through 21 participant interviews, the genealogy of municipal planners' establishment of an infrastructure for participation is outlined and associated practices of participation analysed. Finally, as a critique of possible technical interventions, the challenges of linking various actors' practices through geospatial technologies are scrutinised in two cases from Helsinki (Finland) and Aarhus (Denmark). From each study recommendations for design interventions are drawn.

The findings suggest that 'local' participation draws on the materiality of various places. We find that formal participation processes and infrastructures used accounted poorly for the spatial constellation of material context and local actors who exerted a low influence within established formal participation process. To develop technical interventions that support distributing ownership of participation to various local groups *within* established institutional practices, human computer interactionists need to carefully consider established rules and roles used in both domains, the formal institutions and the many informally-organised actors involved. It is suggested that planners' role shifts beyond that of a mediator towards that of a *facilitator* for local actors' ownership of participation processes, wherein the need for economies of scale and technological compatibility in applying technical interventions may perform as boundaries for *sustainable* technical interventions. It suggests the scope for third parties to aid this process.

To Dzung

DECLARATION OF AUTHORSHIP

This work is submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Digital Innovation.

I declare that the work included within this thesis is my own work and has not been submitted in the same form for the award of a higher degree elsewhere. To the best of my knowledge it does not contain materials previously published or written by another person except where due reference is made in the text.

I declare that CHAPTER 3 was published in the Proceedings of the Conference on Ubiquitous Computing 2012 (Ubicomp'12) in Pittsburgh. For this work, I was the main author taking responsibility for its authoring and editing. I acknowledge that the copyright of published works contained within this thesis resides with the copyright holder(s) of those works.

This work is funded by the Digital Economy program (RCUK Grant EP/G037582/1) of the UK.

ACKNOWLEDGEMENTS

I would like to thank a great number of people. Without their support this work would have been impossible. Many thanks to my advisors for their professionalism, collegiality, and encouragement; the planners at Lancaster City Council, especially Kelly Brown and Maurice Brophy for supporting my study; Dzung for her ability to lift me up; my family for their encouragement and patience in listening to explanations of my work; Michael Korn and Johanna Saad-Sulonen for sharing ideas and inspiration; the many conversations with friends and colleagues of HighWire; HighWire for a great work environment (despite its many organisational conflicts over the years); my former housemate Vanessa Thomas; Adrian Friday for the support on the Ubicomp paper; John who has always been a good friend and inspiringly smart conversation partner; Michaela, Kylie, Ben, Graham of the writing retreat team; Will Medd for his efforts to teach me coaching and reflective skills; Lara Salinas and the CX team for their collaboration on OpenPlanning; Martin Friesl for our regular meet-ups; the many inspiring professors I had a chance to meet including Paul Dourish, Malcolm McCullough and Gerd Kortuem; and lastly the EPSRC for funding me. Finally, I would like to express my deep appreciation to the thesis examiners, Alex Taylor at Microsoft Research and Professor Nick Dunn at ImaginationLancaster, whose feedback has enabled a critical appraisal of this work. My thanks extend to many others that accompanied me over the years in this process and that are not mentioned here.

TABLE OF CONTENTS

LIST OF FIGURES

List of tables

List of terms

Important concepts used within this thesis are listed below in alphabetical order. The glossary of terms specifies the use of these terms given the context of the work undertaken.

Citizen participation	Citizen participation is the act of attending planning meetings or leaving comments on policy documents.
City	A city is understood as a dense network of people and technological infrastructures in a geographical space. Cities are places where *flows* of people, goods, finance, and information join (Castells 2002). They are thus understood not as a place but a *process*. Aspects of urban development are discussed in section 2.2.
Collective action (CA)	Collective action can correspond to a call for participation by a crowd towards a common social goal. In relation to mobile phone sensing, it was defined as "everyday grassroots citizen science across blocks, neighbourhoods, cities, and nations" (Paulos et al. 2008, p. 416).
Collective intelligence (CI)	CI can be understood as an idealised phenomenon for computer-supported collaboration to resolve complex problems. Supported by the Internet, CI relies on averaging the interactions of a large undefined crowd (Surowiecki 2005). This thesis is mostly concerned with resource-allocation problems (focus on land as a limited physical resource). The concept is associated with 'crowdsourcing'.
Commons-based peer production	Commons-based peer production is a term introduced by Benkler (2007). It describes a new form of organisation in which an undefined crowd contributes to the development of an information product (such as a software or knowledge repository) that nobody has exclusive control over and for which participation is largely "self-selected" (i.e. voluntary). It is related to self-organisation.
Common information space (CIS)	CIS is a concept from the domain of computer-supported collaborative work. It describes an often temporary situation in which various disparate information artefacts are brought together by investment of effort. Studies employing the concept describe meetings of engineers working on a project, paperwork circulating within a hospital environment, and air traffic control towers (Bossen

	2002; Rolland et al. 2006; Bannon 2000).
Communicative planning theory	Within the domain of urban planning, this theory is reflective of the critical movement in the social sciences. It pays due regard to the possible barriers in communication between ‘experts’ and ‘non-experts’ (Forester 1989). It appreciates that professional judgement presupposes personal, subjective experience. Adapted from pragmatist accounts of speech philosophies, it postulates that planning is non-rational, evidence is non-neutral. Participation in planning should occur in a manner that, if done correctly, results in communicative rationality (Innes and Booher 2010). Involving many, this outcome relates to collective intelligence.
Community groups	There are different understandings of what ‘community groups’ are and what ‘the community’ means. Healey defined community as a “network of relations and frames of reference that develop amongst those actors interlinked through regular relations around [...] particular sets of issues, from which a shared understanding of issues and debates evolves” (2006). In this thesis, these sets of issues are associated with things that are spatially proximate to these groups and that present key frames of reference for them.
Contextualism	Contextualism is a pragmatist philosophy for social science research that rejects the dualism of positivist and interpretivist methodologies in favour of research approaches that can incorporate both. Its primary method is the case study. Its outcomes are mid-range substantive theories (Mjøset 2009).
Crowdsourcing	Crowdsourcing is a collaboration and production model enabled by the Internet in which an undefined crowd contributes to tasks defined by an individual or group actor (Surowiecki 2005). Unlike commons-based peer production, the organisation initiating the call usually retains control of the terms of collaboration and the final product.
Development proposal	A ‘development proposal’ is part of a formal application for a physical intervention in an urban or rural space. It is submitted by a public or private investor to the relevant local planning authority.
Euclidian	Simple point-to-point distances between two or more objects in

geography	space that can be charted on a geographic map.
Geo-social platforms	This describes a family of online-based software that combine geographic mapping with social networks. Prominent examples were Yelp and Foursquare. They are based on technologies similar to Participatory Planning GIS (PPGIS). Geo-social platforms can be associated with location-based services (LBS).
(Geo)spatial data	Data that is linked to a location by geographic coordinates or by implicit location descriptions such as a street, town or country name. Geographers think that 80% of the information on the Internet has some geographic attribution. For example, a study of German Wikipedia articles found that 57.3% of all articles within the data corpus contained explicit spatial references (Hahmann and Burghardt 2013).
'Global'	"Global" is a descriptor for system-level phenomena, for example a national or international law that commands control over the endpoints of digital information infrastructures accessed by individuals (see 'local'). The term is *relative* to the extent defined for the system.
Governance	In the context of this thesis, governance refers to the *procedures* through which an information technology and the information it serves is maintained and controlled. It is related to the institution which is the set of rules that can be deducted from recurring patterns of governance.
ICT facility	It is similar in meaning to ICT, but makes subtle reference to its role as a resource to store information and make it accessible. The term is used in institutional theory (Hess and Ostrom 2011).
Information infrastructure (II)	II is a concept and sub-domain in information systems research. It is concerned with the study of standard formation and poly-centred governance for an assemblage of various ICTs (Monteiro et al. 2012; Star and Ruhleder 1996). Information infrastructure researchers commonly focus on the use of multiple ICTs across various social and physical settings.
Information communication	ICT describes the hardware and algorithms involved in the digital processing and transmission of information between group and

technology (ICT)	individual actors.
Information system (IS)	This term is both the reference to a concept as well as a domain of study. Information systems are understood as the combination of information communication technologies (ICTs) and the corresponding social context. The domain of information systems has its origin in the wave of computerisation of multi-national enterprises starting in the 1950s (Avison and Elliot 2006).
Institutional analysis and development (IAD) framework	A research method and a conceptual as well as theoretical framework for the analysis of instances of (inter)action of a crowd of individuals or groups that engage in collective action. It was developed by Charlotte Ostrom and represents a substantive theory based on a large number of case studies (Ostrom 1986)
'Local'	"Local" is a descriptor for narrow phenomena within a wider system, for example the neighbourhood level; geographic location of end points of information infrastructures and their users. The term is *relative* to the extent defined for the system. Also see: global.
Location-based services (LBS)	LBS rely on GPS-enabled mobile devices to serve location-relevant information. Unlike classic geographic information systems, the location of the user is used as a factor to personalise the functionalities and views offered on the client's side.
Local plan	In the United Kingdom, a local plan describes a set of policy documents that detail the development criteria for a municipality. Its development is led by the local planning authority (LPA). Previously it was also known as the Local Development Scheme (LDS).
Local planning authority (LPA)	In the United Kingdom, the LPA is a formal institution (usually a group of individuals) with the monopoly to mediate conflicts in urban development. Following formal procedures, the LPA issues building permits and develops public planning policy amongst other functions.
New forms of participation	In this thesis, this concept is associated with different forms of online production models, such as crowdsourcing, or commons-based peer production. They commonly differ in the degree of central authority. In a planning context, novel forms of participation seek to enable capacity for cross-participant interaction, in real-time and on a large

	scale (Townsend 2000). De Lange et al. (2013) associated new forms of participation with ability to name and visualise complex social phenomena, facilitate a 'sense of place' through personalisation (see LBS), facilitate self-organisation supported by peer-to-peer reputation systems and help manage collective action.
Old/traditional forms of participation	These forms of participation are associated with established online consultations ("review and comment interactions") commonplace in planning today (Innes and Booher 2004). Commonly, they afford no, or limited, cross-participant interaction and are defined by terms set by the formal institution.
Open data	Data that can be freely used, modified, and shared by anyone for any purpose (Open Knowledge Foundation, 2015). It has been associated with public sector data and found expression in a great number of open data stores.
Participatory (planning) geographic information system (PPGIS):	Within spatial planning, PPGIS represents a family of online software that apply geospatial technology to citizen participation in planning (Bugs 2012). Related to it, participatory GIS (PGIS) is a stream of work that critiques the technicist use of PPGIS systems. PGIS position GIS as software that can be used in the coordination of community groups (Talen 2000). This links to the concept of self-organisation.
Patterns of interaction	Patterns of interaction refer to the regularities in interaction reported by participants in planning consultations (such as municipal planners, various community groups, organisational representatives) and those that can be identified across time in the study of planning participation processes (such as a certain number of consultations before the adoption of a municipal plan document and the recurring interactions that evolve from repeated participation events).
Personal data	This concept describes a set of digital information attributes that describe detailed characteristics of a citizen. It refers "to data and metadata relating to a specific, identified or identifiable person." (World Economic Forum 2012). Different terms were used across disciplines such as citizen-generated media (Saad-Sulonen 2012), personal participatory data (Shilton 2012), and volunteered geographic information (Goodchild 2007). The primary form of personal data within this thesis was actively contributed comments on plan documents, but underlying that are other more intrusive

	meta-data such as the location of the citizen, past commenting patterns, organisational affiliation, and so forth. Most social media applications on the Internet depend on the sharing and integration of personal data.
Physical space /geographic space	Physical space draws attention to the role of geographic locale and its associated context for social interaction with and through digital infrastructures. For example, in human computer interaction, physical space has been recognised as social infrastructure (Dourish and Bell 2007). In this thesis, the concept of physical space is further associated with ownership and use of land.
Self-organisation	This term is associated with institutional theory. It relates to the ownership of the outcomes but also to terms of collaboration. For a crowd of individuals and group actors, self-organisation expresses an ability to resolve complex problems by themselves. This may involve capacity-building in which appropriate contexts are found that are conducive to self-organisation.
Urban change	This concept suggests a certain temporality for changes in physical and social make-up of a city. It is associated with the fact that cities never stop changing (Wegener et al. 1986).
Urban development	Urban development is a concept that implies the build-up and the roll out of infrastructures (S. Graham and Marvin 2001). It has a normative connotation in respect to Western development ideals that could be associated with neo-liberalist drivers in urban development.
Urban planning (UP)	Urban planning is the science and art of controlling and shaping the physical development of cities.

CHAPTER 1

INTRODUCTION

This chapter introduces the content, form, and structure of this thesis. It offers an overview of the five chapters that comprise the thesis's contribution, but before detailing the content and structure of this work, allow me to outline the research motivations that directed and sustained this research effort. It makes clear how, subsequently, personal aspirations were translated into actionable research projects and the research question.

1.1 Research motivations

From the outset in 2010, discussions with peers at HighWire, study of the literature, and various conferences attended in ubiquitous computing, urban planning, and geography information systems[1] have prompted my interest in the advancing digitalisation of society. Increasingly, collaborative arrangements rely on the data generated by citizens on digital services and shared online (Saad-Sulonen 2012; Goodchild 2007). Meanwhile, as commercial organisations and public bodies aggregate such information systematically, the use of digital technologies involved in producing, processing, and serving information should move towards a social point of view to support citizens' contributions to the making of their city (de Lange and de Waal 2013). Inevitably, when discussing any form of citizen collaboration and participation, it leads to questions about control and ownership of digital infrastructures as those are essentially linked.

My attendance at the UK's geographic information systems research conference (GISRUK'12) made evident to me the dilemmas digital infrastructures face. For urban systems, geographic information science has been at the centre of the collection, storage, and processing of data related to physical space. Motivated to study travel patterns on a city-scale, two presenters presented a detailed map of the commute for three Twitter users in Birmingham (see Turner and Malleson 2012). In the debate that followed, the audience split into those who advocated access to 'big data' for research purposes and those who pointed to the risk of privacy invasion for individuals. These three Twitter users are unlikely to learn about their inclusion in this study. Had they known, would they have objected to the audience following their daily moves? Would they have seen a higher

---

[1] Ubiquitous computing: Ubicomp'12 in Pittsburgh, Workshop on systems to further local off-line interactions, and Ubi Summer School '13 in Oulu; urban planning: Stadtkolloquium at UCL '13 and The 10th meeting of Aesop's Thematic Workgroup on Complexity & Planning; geographic information systems: GISRUK conference '12

cause in 'volunteering' their mobility traces? From the individuals’ standpoint, such goal-driven aggregation of citizen-contributed data, raised as part of everyday interactions in urban spaces, challenges established conceptions of what it means to participate in collective endeavours.

Several months later towards the end of 2013, Professor Barry Smyth, an entrepreneur and proponent of ‘big data’, gave a lecture at Lancaster. He noted that global digital infrastructures now generate one Exabyte of data per day, enough to store the US Library of Congress’s catalogue[2] of printed material twenty thousand times over (Smyth 2013), a trend driven by the embedding of digital sensors into various physical objects. It was estimated that cities will feature 1.1 billion connected devices by 2015 rising to 9.7 billion by 2020 (Gartner 2015). Public spaces can expect significant changes as they are being augmented by a digital layer in the form of Internet-connected lampposts, traffic lights, environmental sensors, etc. For mobile devices, Smyth mentioned applications in personal health, fitness, and commuting. Yet, he avoided answering how individuals’ data from different (commercial/public) systems may be controlled and what implications this might have on the relationship, for example, between the individual and the state.

This encouraged me to attend the Ubi Summer School ’13 in Oulu, a meeting point for future computing scientists, to meet Professor Malcolm McCullough. With a background in architecture, Professor McCullough had strong opinions on the confluence of fleeting data and permanent physical structures. As data storage costs fall and digital systems diffuse into everyday objects, it becomes feasible to capture evermore nuanced and detailed information on social interactions within urban space. In his view, all interaction data in the “long-tail”, the vast instances of infrequent interaction, should never be captured and stored indefinitely for analysis (McCullough 2005). For urban computing, as a discipline concerned with the augmentation of the city by use of digital infrastructures (Foth et al. 2011), he cautioned that digital automation and augmentation must be deployed responsibly. Grounding his argument in the cognitive sciences, he suggests that human beings deeply depend on the physical textures, smells, and impressions of their physical surroundings (McCullough 2013). Thus he warned against covering ‘analogue’ physical spaces with a layer of seamless digital technologies if it only draws citizens into artificial, distorted, and supervised mirror worlds.

[2] As of 2015, the Library of Congress in Washington D.C. is one of the largest libraries in the world. Its catalogue contains 160 million items including 37.8 million books and other print material in 470 languages.

In the future, data from digital infrastructures may offer an "opportunity to understand the mutating complexity of the contemporary city" (Ratti et al. 2006). Perhaps through self-organised evidence collection, local actors such as community groups may take charge of planning problems (Boonstra and Boelens 2011). This may contribute to a revised form of networked democracy (Bruns 2008) that will require (political) institutions and infrastructure providers to offer greater influence over collection, access, storage, and use of information about them (Shilton 2012).

1.2 Position statement

In this thesis, it is recognised that digital infrastructures can contribute towards new forms of interaction by naming and visualising complex social phenomena, facilitating a 'sense of place' through personalisation, and supporting self-organisation through peer-to-peer reputation systems (de Lange and de Waal 2013). For example, the Ushahidi platform, used during the Haiti crisis in 2010, supported the mapping of emergency zones and the location of helpers and resources (Meier 2012). In just four days, helpers reproduced a comprehensive street map of Haiti based on satellite data (Meier 2012). Such novel modes of collective action involving volunteers, emergency coordinators, residents, etc. demonstrate the coordinative capacity of online ICTs being accessible to many.

In non-emergency situations, we need to be critical about who owns, manages and deploys the systems and data that power our cities and avoid a store-everything approach, a mentality advocated by some. While recent discussions of homogenous, centrally controlled 'urban operation systems' (see Lindsay 2010) are reminiscent of the proposition of urban intelligence centres (Webber 1965, p. 289) in the past, we need to recognise that the specific-realisable opportunities for novel forms of participation fail to be accommodated within technical utopias if they discharge current social practice at the expense of a techno-driven vision (compare Rogers 2006). In this complex problem space, such utopias rarely address the broad range of stakeholders and risk simplifying both the problems of power and authority and thus the specific-realisable opportunities — and the work in this thesis demonstrates this.

Instead of chasing idealised forms of digital infrastructures, it is useful to investigate the practices surrounding digital infrastructures produced in situ, and in the real world. This requires a view that extends the research beyond single sites, social settings, or technologies (Monteiro et al. 2012) and focuses on mundane practices that are accomplished involving various ICTs (Galloway 2004). While cumbersome, such explorations of the problem space contribute towards technical interventions that balance the needs and wants of various groups by reaching a comprehensive evaluation. For example, considering existing practices of information sharing helps to contrast individuals' ownership requirements over data with any realisable benefits from sharing this data with society at large[3]. Focus on social practices across various media and in reference to changes in the content of the city can overcome established dichotomies of 'local' and 'global', or 'digital' and 'physical' (Crang et al. 2007).

At particular times and in specific use cases, the legislative choices by policy makers, the design choices of ICT developers, and citizens' demands result in socio-technical contexts in which the risks, and benefits of ubiquitous ICT application are constantly re-evaluated. That is why, I called for a research agenda on citizen participation in ICT systems and data that relates to the citizens' activities in and with space (Weise, Hardy, Agarwal, Coulton, Friday and Chiasson 2012a). In this thesis I elaborate practical suggestions in the specific context of urban planning.

1.3 Research scope

Addressing the problem space from a pragmatic angle, this thesis focuses on participation in *urban planning* to critique the design of digital infrastructures through the practices of actors in planning. As an established process of political decision-making (Kubicek 2010), urban planning is concerned with "ordering the use of land and the character and siting of buildings" (Wyatt and Ralphs 2003). It is therefore concerned with the adaptations of the physical environment shared among diverse actor groups. On the surface, municipal planners emerge as actors to organise participation for diverse citizen groups (Forester 1989; Innes and Booher 2010) and to systematically aggregate data ('evidence') to inform possible problem solutions. In planning, problems are political, open for debate, and hence information generated for planning cannot be divorced from its original social context (Innes and Booher 2010).

By taking the approach of 'transduction' (Dodge and Kitchin 2005), this thesis considers existing forms of participation in planning[4] and the practices of a range of individuals to establish opportunities for transformation of practices in the future. Transduction means that practices involving techniques and technologies of today are

---

[3] Taking up the example provided earlier, the tracing through an extended design view would contribute towards resolving in which specific contexts and purpose using Twitter by a local authority might be useful.

[4] The predominant contribution citizens make in the planning system today is in the form of comments on policy documents and by attending face-to-face workshops and events.

distinguished from those of tomorrow by an on-going evolution (S. Graham 2004). The practice of *writing* a printed table is different from using a digital spreadsheet, but the intention of the action may ultimately remain the same. Likewise, the practices involving 19^{th} century digital lithography for street advertising may be different from the uses of locative social media today, while each can be seen as a form of expression.

Therefore, any vision of a technical intervention needs to fit, to some extent, the existing set-up to transform practices over time. Unfortunately, computer scientists rarely have the time or motivation to consider the rules that govern (everyday) practices involving their technologies (Galloway 2004), roles, and responsibilities in their technical interventions (Jackson et al. 2014). For the design of digital infrastructures, existing social practices of organising participation in planning thus help to *critique* the quality and use of digital systems and the data they produce.

In addition, geographical space has been underserved in digital infrastructures research (Goodchild et al. 2000; S. Graham 2004; M. Graham and Zook 2013). Urban planning's focus on the uses of land, a limited resource, forces us to appreciate the role of geographical space in citizen participation and hence the control of information infrastructures for it. Information for urban planning naturally comes with an association with places and spaces. Normative questions of authority over ICTs and data across communities in various physical spaces and social settings contribute to the complexity of digital infrastructures that enable various groups to participate. Hence, embedding of new forms of participation in planning involves the resolution of conflicts in interest *and* distribution of process ownership amongst individuals distributed across and with interest in various places. Seen in this way, urban planning takes on an important role in the debate on the design of data-driven public services (Staffans and Horelli 2014).

1.4 Approach and research question

In contrast to past studies of information systems, my work takes an extended design view not confined to isolated social settings, localities, or technologies (Monteiro et al. 2012) to consider the *infrastructural role* of various ICTs in combination. In three different urban planning cases, I studied forms of participation. I analysed the organisation of participation for actors including planners, technologists, and citizen groups. My studies encountered dilemmas in inclusion, exclusion, and power in organising digital infrastructures. The content of this thesis revolves around a key research question, that is: **What existing and emergent social practices in urban planning indicate institutional and technical reforms suitable to new forms of participation?**

In its methodology, the thesis relies on an approach to human computer interaction based on institutional theory. Institutions are understood as the set(s) of rules that describe observable habitual practices (Hess and Ostrom 2011). Institutions arise when social interactions regularise to get a job done. This definition supports an analytical frame that subsumes both formal established ‘institutions’ (such as a local municipal government) and the informal organisation of various community groups within a network of relations. For its focus on never-quite achieved futures in ubicomp (Rogers 2006), *institutions* have been underserved in computer scientists’ studies and also in the work on digital infrastructures (Monteiro et al. 2012).

Later, the specific case of geospatial technologies for collaborative planning is used to illustrate the wider problem, namely that it has remained ambiguous how digital systems should be designed to benefit both the established institution (including planners) and the wide range of possible ’new’ institutions (including citizen groups directly exposed to planning problems) (Bugs 2012).

1.5 Format and structure

The format of this thesis mirrors that of the alternative thesis format[5]. Thus, apart from the introduction and the conclusion, each chapter in this thesis is presented as a research article. Owing to the interdisciplinary, complex nature of the planning domain, this format separates my argument out into distinct pieces. This enabled me to address the different but connected scholarly domains relevant to this work (urban planning, human computer interaction, information systems, and geographic information systems research) while upholding an overall narrative linking these separate pieces with each other and to my research question.

Over a period of five years, the articles in this thesis reflect a long, and on-going intellectual journey. As illustrated in Figure 1, the thesis includes different ‘types’ of articles starting with two conceptual, one methodological, and three empirical articles as indicated by the colour coding. Within the thesis, cross references flag relevant content from related chapters; and to help the reader in the transition from one chapter to the next, notes are placed at the end of each chapter to introduce the next. Due to encouragement by the examiners of this work, these transition pieces have been used to

[5] Lancaster University’s Manual of Academic Regulations and Procedures provides the example of the alternative format as one “being a series of related articles suitable for journal publication”.

serve critique of the content with the benefit of hindsight. I have made use of footnotes to expand on concepts where necessary.

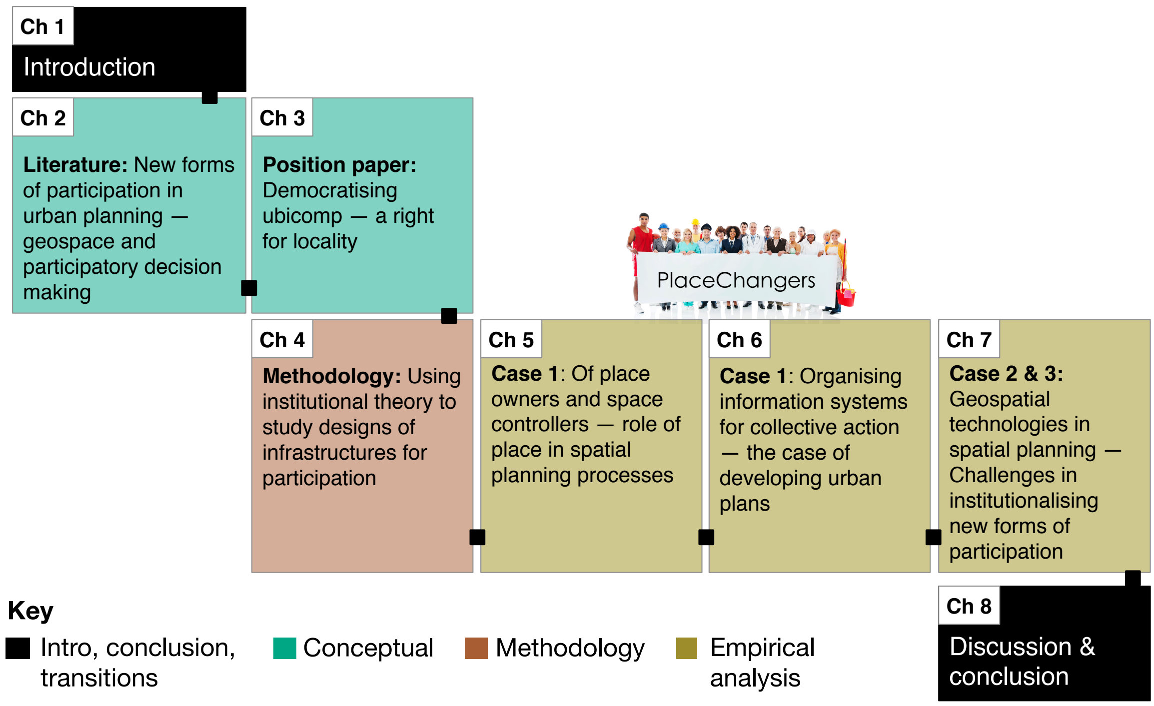


Figure 1: Outline and sequence of chapters

The literature review (CHAPTER 2) and position paper (CHAPTER 3) represent the conceptual and intellectual basis for my work. The literature review, which precedes and complements the position paper, has been updated and includes sections on urban planning practice in the UK. The position paper was published in 2012 and has, since then, remained unchanged. In comparison to the original position paper, the literature review emphasises geospatial technologies, capable of processing geospatial data for urban planning applications. The thesis's methodology, presented in CHAPTER 4, describes the conceptual framework, drawn from institutional theory, and the methodology for the empirical work. The methodology is also used as an overall reflection on the methods employed throughout the thesis. Each chapter includes a separate literature review and methodology section to specify the data sources and the analysis techniques.

1.6 Overview of thesis content

Table 1 (below) elaborates the content of each chapter and their contribution to the main research question.

CHAPTER 2

Contextual review | **New forms of participation in urban planning — geospace and participatory decision making.**

Planning as an institutional process of communication mediated by different information communication technologies (ICTs) emerges as an important arena for the use of digital infrastructures in the urban context. This literature review for urban development and planning practice introduces the temporal-spatial, relational character of urban development as a pretext and constraint to participation in planning. New forms of participation in planning are introduced, such as crowdsourcing and open-source peer production. Focusing on self-organisation in planning practice, the article focuses on geospatial technologies including participatory geographic information systems (GIS) and their use in planning.

CHAPTER 3

Position paper (published: UbiComp'12) | **Democratising ubiquitous computing — a right for locality.**

The position paper *Democratising ubiquitous computing — a right for locality* was presented at Ubicomp'12, a conference on research in ubiquitous computing systems. Acceptance rate that year was 19%. It discusses the relationship between physical space and digital infrastructures in an urban context. The paper makes the case that the increasing digitalisation of various urban processes leads to the emergence of ubiquitous computing infrastructures. It draws attention to the role of geospatial scales in urban development (neighbourhood, city, nation state, global) and relates those to the governance of these digital infrastructures. It reveals that the developments in the field so far have poorly grasped the already existing groups of actors that perform important roles in the social organisation of cities. Corresponding with Townsend's (2014) suggestion that technology corporations and institutional actors have thus far struggled to appreciate the role of local indigenous actors in their technical agendas, we suggest the concept of 'community data'. It calls for consideration of data streams collected from a locality that may also be of use for the urban development in this locality.

CHAPTER 4

Methodology paper (submitted: Journal of Community Informatics) | **Using institutional theory to study the designs of infrastructures for participation.**

Following a review of practices of participation in urban planning and the argument for control of urban computing systems in the position paper, this article presents a methodology for case studies of information communication technologies, information, and people in a *particular environment*. The theoretical framework of this methodology relies on the Institutional Analysis and Development Framework (Hess and Ostrom 2006) and is complementary to activity theory studies popular in HCI (Bertelsen and Bødker 2003). The outcome is an institutional analysis methodology suitable for studying digital infrastructures that are accessible to a large, geographically distributed user base. The methodology helps in tracing 'institutions' as layers[6] of established habitual practices (that are seen as unwritten "rules" for interactions), and therefore lends itself to understanding aspects of governance in a digital infrastructure. The article uses the empirical studies undertaken as examples for the application of the methodology.

CHAPTER 5 **Empirical analysis, case 1 (intended: Environment & Planning B) | Of place owners and space controllers — role of place in institutional planning processes**

The geographic focus in this case is the District of Lancaster, a semi-rural municipality in the North West of the UK. The article examines the archival records of two online consultations led by municipal planners to study the organisation of the *community* involved in the development of a spatial plan[7]. Based on a *spatial* analysis of the contributor-comment-places linkages, the goal is to articulate practices of participation in relation to places[8]. We find clusters of activism, both, within the Lancaster district and several hotspots of activity across the UK. While local residents were the largest in number, this group had the lowest impact on the spatial plan in these two consultations. Drawing on Dourish et al. (2007), who emphasised that "material and physical circumstances" are not a mere "passive physical container" for ICT application, the article suggests that participation

[6] It distinguishes between layers of rulemaking (operation and collective choices) that influence the organisation of digital infrastructures at different levels.

[7] In this case, planners worked on two important policy documents that contribute to the 'local plan'. These were a Development Management document and a Land Allocations document.

[8] This remains underserved in research on social interactions in and with technology (Goodchild et al. 2000; M. Graham and Zook 2013) but also in current planning practice (Royal Town Planning Institute 2014)

inequalities in relation to physical space may be faced by distributing authority further out to people in these spaces ('self-organisation'). It then debates the consequences that support of self-organisation may have for designing institutions and complementary digital infrastructures.

CHAPTER 6 **Empirical analysis, case 1 (intended: Information & Organisation Journal) | Organising information systems for collective action — the case of urban plan development**

Focusing on the same case as in CHAPTER 5, this chapter analyses the established institutional processes in greater detail based on interview data. Unlike studies focussing on ICTs in isolation, an 'ecological' study of the information system is presented. Drawing on archival data and primary data from process-retrospective interviews with 21 citizens, selected through purposeful sampling (including urban planners and contributors in consultations), it analyses the practices of organising opportunities for participation and their supporting technical infrastructure in influencing a local plan. The article draws on the analysis methodology (CHAPTER 4) to conceptualise two layers of rulemaking — in the adaptation of the infrastructure (consisting of various non-compatible ICTs used across various stakeholders) and the activities depending on it. This points to the complexity of participating across social contexts and physical settings for which study participants made use of various ICTs in combination (the technical infrastructure). Practical dilemmas that the organisers as public planners faced in offering an information infrastructure for equal participation are highlighted.

CHAPTER 7 **Empirical analysis, cases 2 and 3 (submitted: CHI'16 conference)| Geospatial technologies in spatial planning — challenges of institutionalising new forms of participation.**

Finally, to understand the practicalities and complexities of technical interventions in urban planning, this article analyses the experiences of two experts who sought to empower community groups through collaborative mapping applications. Guided by the institutional methodology (CHAPTER 4) to achieve a case comparison, data came from online interviews with these two technical experts[9] who intervened in planning participation with

[9] Later referred to as "technical facilitators" (Saad-Sulonen 2012)

bespoke ICT facilities. The geographical focus switches to Scandinavia, known for innovative approaches to participation (in ICT design). Both projects offered new forms of (inter)action (e.g. through concepts of "action & reflection", "in-situ participation", "multiple participations") aided by location-enabled smartphones and/or online mapping. Critiquing observed practices in the Lancaster case, this article highlights emergent capacities for and difficulties of self-organised participation supported by ICTs. It identifies technical and institutional challenges in establishing, advertising, and *sustaining* the new forms of participation. The outcomes contributed to the main thesis statement, that computer scientists and others who undertake technical intervention attempt to redistribute ownership over terms of collaboration and the ICTs involved and thus need to understand and, to some level stick with, the *processes of established institutions* if they seek to change those over the long-term.

Table 1: Content of chapters included in this thesis

1.7 Outlook on thesis' contributions

In this thesis, new forms of interaction are those that come about through the mediation of a digital infrastructure and that increasingly depend on user-generated data and more often voluntary participation[10]. De Lange et al. (2013) associated these new forms of participation with the ability to name and visualise complex social phenomena, facilitate a 'sense of place' through personalisation, facilitate self-organisation supported by peer-to-peer reputation systems, and help manage collective action. Following a focus on existing practices of actors in urban planning, the thesis's conclusions underlie the premise that the provision of a technological system does not automatically result in a transformation in the patterns of participation, or even cause participation at all. Instead, successful interventions depend on the laborious resolution of institutional and technical questions in parallel and over time. Tracing these institutional and technical questions through established patterns of interaction is a focus of this work.

Given the complex domain, the work ahead draws on a mix of spatial analysis and established ethnographic methods. Spatial analysis will suggest that local residents were less likely to influence urban plans while at the same time several networks of activity clusters could be identified, occasionally within a small geographic area, that correspond

[10] See 'new forms of participation' in the glossary

to the main settlements in the area. Further ethnographic analysis will finds that local residents, often non-experts, had less advanced practices of engaging and re-engaging and that their participation was more place-specific and irregular than those of other professional actors. If established authorities in these settlements may be given a greater role in collating and maintaining information, it would require revisions to the set-up of current participation procedures. However, technical interventions aimed at providing a remedy are more complex than often thought. Nascent practices in supporting local community groups in urban change using locative media technologies will find that strong barriers existed in embedding such technical interventions within the established institutional practices of planners.

The cases illustrate the complexity required to appreciate existing practice and the resulting persistent effort necessary in linking new technological capacities with the established institution's formal processes and the informal processes of local actor groups. The approach illustrates that technical utopias or simplistic technical interventions avoid addressing the broad range of stakeholders and thus risk missing both the problems and the specific-realisable opportunities within existing social practices. The discussion is in tension with the assumptions that ICTs remove participation barriers by reducing geographical distances. The spatial character of urban development links virtual interactions firmly to spatial outcomes — each associated with various actors that take an interest in them. In acknowledging this circumstance, the discussion of physical space as arenas for action regains importance in determining institutional configurations that mediate the access to and control over digital infrastructures and the forms of participation that they might enable.

Transition

The following chapter presents the literature review and develops the research question **as to which existing and emergent social practices in urban planning indicate institutional and technical reforms suitable to new forms of participation**. This chapter sets out the link between information communication technologies (ICTs) and physical space. This link is elaborated in CHAPTER 3 that discusses important governance challenges in ubiquitously accessible digital infrastructures. As an example of where these spatial links become apparent, the chapter focuses on urban planning processes which employ many ICTs to aid citizen participation in relation to their urban environment. I emphasise geospatial platforms and location-based services where these spatial links become apparent and link them with conceptualisations of 'novel forms of participation' popular in contemporary literature. To emphasise the importance of physical space throughout this thesis, the final part of the article touches on governance of place-based media and underlying technical infrastructures.

In hindsight it should be noted that the forthcoming chapter is the product of my early work and thinking. Although the chapter received substantial adaptations throughout the write-up of this thesis, the reader may perceive a leaning towards bottom-up 'self-organisation' as expressed by Boonstra and Boelens (2011). This self-organisation was associated with practices of community groups and other informal actors attached and enmeshed in a matter of concern to resolve this by themselves. It serves to describe institutional revisions through which such local 'civics' may be trusted with greater roles in information governance, the management and control of data collated from their vicinity and the establishment of rules for governing this data. In hindsight, as I went through the ethnographic studies contributing towards this thesis, I had the opportunity to revise and relativise my position. Between citizen activism, corporate clientele and established political administration, a middle-out approach, for example alluding to a cooperative relationship between local government and the various community and informal actors, may be more appropriate.

CHAPTER 2

NEW FORMS OF PARTICIPATION IN URBAN PLANNING — PLACES AND PARTICIPATORY DECISION MAKING

2.1 Abstract

This article reviews the literature on digital infrastructures[11] *in urban development. There are three parts. The first part (2.2) sets the context, introduces a relational process view of urban development in the 'post-modern' literature. The second part (2.3) details established means of participation in urban development, discusses the pivotal role of established institutions*[12] *and their technical systems, and outlines urban planning as a domain with its own formal processes for intervening in urban change. Since delivering new forms of participation*[13] *calls for the adaption of institutions to new rules of interaction, the third part (2.4) reviews collaborative practices on the Internet. It focuses on linking off- and online activities, the steering of individual inputs into collective outputs, and the provision of incentives for voluntary participation.*

2.2 Spatial outcomes in urban development in the networked society

In this part of the literature review, it is argued that the on-going digitalisation of society fundamentally changes the relationship between human practices and their material context(s). Scholars, who focused on the *functional opportunities* from digitalisation, pointed to improved processes for managing cities that leverage the deeper links between people, places, and technologies. Here, Internet-connected mobile phones have contributed to a communication revolution in contemporary society and are now

---

[11] The importance of infrastructures in city development is further outlined in Weise et al (2012) - CHAPTER 3 in this thesis.

[12] *Following the new institutional view, institutions are understood as socially constructed rule systems that emerge over time from recurring practices*[12] (Ostrom 2005). Beyond the focus on established political organisations, Innes et al (2012: p.42) defined it broadly as "formal and informal rules that are understood and used by a community".

[13] In this thesis, new forms of participation are associated with different forms of crowd interactions mediated by digital technologies. A well-known example includes Wikipedia, the largest collaborative generated encyclopaedia in the world.

leading to the 'real-time' city (Townsend 2000). Digitally augmented urban systems facilitate the naming and visualisation of complex social problems in urban spaces (de Lange and de Waal 2013). Scholars also attended to the ethical and power dimensions of digitalisation as the *effects* of global flows of people, economic goods, money, and data materialised in various *'local' places* (Castells 2010). Thus, the discussion has been manifested on the level of control over *outcomes* but increasingly also the *(technological) means* by which these outcomes may be achieved (see de Lange and de Waal 2013).

2.2.1 Past views of urban development

Before the widespread provision and deployment of digital infrastructures that permeate urban life today[14], comprehension of the mobility and dynamics of cities was limited. Scholars might have thought about monitoring systems[15] for urban development in the 1960s (Downs 1967; Webber 1965). However, due to the technological complexity and immaturity of digital infrastructures at the time, data models were rarely fit for use in citizens' day-to-day decision making[16] (Townsend 2013). Downs (1967, p. 2010) concluded that payoffs from "automated data systems are much more difficult to demonstrate than technical improvements in *data*".

Urban development featured a "rationalised, modernist, and 'scientific' approach" (Graham et al., 1999, p.624). Planners, saw urban space[17] as being composed of well-bounded, identifiable *functional* units delineated by straight-line geography. Cities were understood as *static* objects described by their "stocks of people, goods, buildings, and wealth" (Webber 1965) and in equilibrium with their environment; whereas not much regard was given to *flows* of materials, people and money within, into, and out of cities across decades, years, weeks or days (Townsend 2013). In building urban spaces, planners

---

[14] It was estimated that cities feature 1.1 billion connected devices in 2015 rising to 9.7 billion by 2020 (Gartner 2015). In the UK, 99% of 16 to 24-year-olds have used the Internet; and more than 50% of adults now carry a smartphone (Local Government Association 2015, p. 17).

[15] This citation is not meant to be an endorsement of such technology-driven visions but merely an indication that such debates repeat themselves over time and are now found in the debate on the 'smart city' (compare Hollands 2008).

[16] Townsend (2014, p.59) provides the example of the manual tabulation of the 1880 census that took 1500 workers seven years to calculate. While calculators, such as IBM's punch card calculators (a version of an early computer), speeded up the calculation from the 1890s onwards, accessibility to the results of the census was limited to a paper format.

[17] See glossary, "physical space"

emphasised generalisability of city designs that assumed the homogeneity in the functional use of city districts.

In a critique of a 'straightening of landscapes' resulting from the fast expansion of suburbia due to the private mobility boom, Jacobs (1961) noted that unplanned urban settlements, while messy and complex, feature patterns similar to those found in nature[18]. Models and conceptualisations of urban development should avoid separating neighbourhoods into different socio-economical functions (Alexander 1966) and heed the example of the organic structures/developments observed in nature.

In line with this view, Rittel et al. (1973), critiqued the supposedly 'scientific' approach to problem solving in urban planning. Using the "wicked problems" metaphor, they drew attention to the social complexity of planning problems, such as the inability to propose solutions without exploring the problem itself. Instead, the open-ended nature of urban development requires a continuous "re-solving" of the status quo whilst systematically revisiting the problem. Every problem is unique in its own right. Considering the iterative approaches required in wicked problems, a problem solution quickly becomes a highly political question that goes beyond what a pure engineering challenge may be able to solve.

2.2.2 The networked view of urban development

Critiques of the 'scientific' approach to city planning in the 1960s and ’70s are the origin of a *relational* process[19] view of city development; a view now widely accepted in research by urban sociologists (see Castells 2000), (critical) geographers (Massey 1993; M. Graham and Zook 2013), and post-modern philosophers (see Latour 1962). This shift in thinking is substantiated by the advances in digital infrastructures that provide all actors in urban development with insight into the *flows* that comprise the city's physical structure as it finds expression in the capacity to analyse cities' complex interactions.

Real-time data streams from various networked technical systems offer residents, researchers, planners, and other interested individuals instantaneous detailed insights into the dynamics underlying cities (Ratti et al. 2007). For example, a range of academic projects (see Figure 2) reconstructed social interaction in relation to physical space

---

[18] She argued that for practical reasons, established statistical models applied by planners had often assumed variables of different phenomena as unrelated although, in fact, in city systems variables are usually interrelated in complex ways. She termed this phenomenon "organised complexity".

[19] By that I mean a consideration of time in analysis.

through the location of mobile phones in Milan (Ratti et al. 2006), the GPS[20]-traces of taxicabs in Shanghai (Zheng et al. 2011), check-ins at events and venues in Paris (Bawa-Cavia 2011), and social networks posts from the Netherlands (M. Graham and Zook 2013). The capacity to capture and analyse data on urban processes in high temporal (day by day as opposed to year by year) and spatial (from the neighbourhood to the nation state and beyond) resolution, shifts attention from spatially bounded areas and static stocks to the many boundless, concurrent interactions that alter the city over time. For this review, such academic studies signal opportunities for novel ways of understanding the physical environment of cities, for example, via the ability to name and visualise complex social phenomena (de Lange and de Waal 2013).

Please note: Images were removed in public version to preserve authors' copy right.

Figure 2: Understanding the city through its flows using data from Foursquare for Paris (a), Twitter for the Netherlands (b), mobile phone locations for Rome (c), or locations of taxicabs in Shanghai (d).

How the underlying technologies may be experienced or brought to use in *practice(s)* to transform the means of participation is often left unanswered[21]. This gap is researched within the new domain of urban informatics, that Foth et al. (2011) placed at

[20] GPS stands for Global Positioning System, a global standard in Satellite-aided navigation

[21] CHAPTER 3, serving as position paper for this thesis, will develop this further.

the boundary of physical places[22], citizens, and digital technologies. They defined it as "the study, design, and practice of *urban experiences* across different *urban contexts* that are created by new opportunities of real-time, ubiquitous technology and the augmentation that mediates the physical and digital layers of people networks and urban infrastructures" (Foth et al. 2011, p. 4). Thus, for understanding the 'user experience' of participating in and through a city's physical structure, close attention should be paid to the overlapping of digital infrastructures and geographic space in their social relations.

2.2.3 Dimensions of the network view

Drawing on literature relevant to urban planning and urban informatics, the contemporary view of cities sees them as *network entities*. In the words of the urban sociologist Castell, cities can be seen as *places* within the global *space of flows* (Castells 2010). Here, this view is separated into three dimensions. First, the city is described as an unbounded, dynamic, socio-technical network of links among citizens, infrastructures, and the physical environment. Second, the city as a process dimension implies that urban change consists of many concurrent processes of different speeds. Third, urban places are entangled in power relations (Innes and Booher 2010; Massey 1993) that are now mediated, enacted, and resolved by various information communication technologies (ICTs). For this review, these three dimensions circumscribe key constraints that apply to any interventions within urban development.

2.2.3.1 The socio-technical dimension

As is further discussed in CHAPTER 3, cities are complex socio-technical systems. Graham et al. (2001) noted that urban development involves the roll-out of infrastructures. So called "purpose systems" (such as electricity, water, and telecommunication networks) represent 'hard' infrastructures (Arthur 2009). These technologies are a "skeleton" to society that enable complex economic and social interactions between citizens to occur. For cities, empirical analysis suggested that continuous improvements in technical infrastructures are required to sustain an increasing density in the local population (Bettencourt et al. 2007).

[22] A key aspect is the *physical space* composed of the natural topography of the land and beyond that of the man-made structure of the city and its buildings. Its permanence provides the surface for the interactions, and, importantly, experiences, that citizens have across different physical settings and technologies.

High population densities in cities lead to specialisation in work and culture (Simmel 1903). The density of inhabitants and technologies makes the urban context an ideal context to experiment with novel forms of participation with and through technology (Townsend 2013). For example, Townsend (2000) mentions that mobile communication networks have made taxi drivers far more efficient in finding customers, making their coordination appear smooth and intelligent. A phenomenon that some might describe as "collective intelligence" (Surowiecki 2005). Geo-social services such as Foursquare, Yelp and others allow citizens to 'tag' the city and provide a level of digital mark-up comparable to the revolution induced by colour lithography at the beginning of the 20^{th} century and as expressed in street-art in Berlin (McCullough 2013). As a result, innovative new product-service systems are emerging that blend everyday social activity with digital networks. Digital technologies build up an infrastructure for collective action (Weise, Hardy, Agarwal, Coulton, Friday and Chiasson 2012a).

2.2.3.2 The spatial-temporal dimension

In the network view, cities are seen as a continuously changing rather than a static entity; development is an "embedded and heterogeneous time-space process" (S. Graham and Healey 1999). Annually only 2% of the built environment of a city changes. Urban change may be a result of spatial interventions of various types and scales (Wegener et al. 1986). At the most extreme, the effects of infrastructure development can be experienced more than 100 years after construction (Wegener et al. 1986). Large spatial interventions, such as the construction of airports, consume vast amounts of resources and are often a life-time experience for the architects, engineers, and workers involved (Flyvbjerg 2005). In comparison, small interventions scattered across various physical locations are far more common in contributing to urban change.

For digital augmentation, the permanence of physical structures in the built environment of cities provides a stable "ground" to the often short-lived, real-time streams of urban data (McCullough 2005) and facilitates understanding of social interactions in and with the urban space (McCullough 2013). The networked city as hybrid of the physical and digital (de Lange and de Waal 2013) gives urban data permanence. 'Digital traces', such as place-related tags on location-based services (such as Yelp, FourSquare, etc.) become powerful implicit augmentations to the experience of space (Kelley 2014). Hence, digital technologies play an increasing role in spatial outcomes through the subtle influence of user-generated content on citizens' choices (Kelley 2014). Thus, while ICT researchers discussed cyberspace mostly as distinct from physical geographies (S. Graham 2004), this is now changing (Zook and M. Graham 2007). Drawing on cases of community groups in post-financial crises Detroit, Dunn (2013) calls for new forms of networked city governance in which interfaces should be "interactive instruments" facilitating the capacity for change, exploiting the situated socio-temporal flows of social processes. These interactive instruments are thought to contribute towards "knowledge production in the 'real' terrain between the physical and the digital" in which interactions can be both bottom-up and top-down at the same time.

To understand the networked city including its digital mark-up, critical researchers argued to focus on the *social practices* that bind the various analytical categories, such as the artificial distinction between "real" and "virtual" (Crang et al. 2007), the "old" and "new" (Galloway 2004), and arguably the "local" and the "global". Practices implicitly bring technologies to life in mundane actions (Galloway 2004). Similarly, Castells (2010, p. 2742)'s remarks, "infrastructure(s) of communication develop because there is something to communicate. It is this functional need that calls for the development of infrastructures." Temporality to data from a city's technical infrastructures, inhabitants, and visitors is important for understanding these *evolutionary* processes (M. Graham et al. 2013) across the socio-cultural infrastructure that *space* provides (Dourish and Bell 2007). In the *networked view* of urban development, the tracing of interactions involving places, groups, and technologies thus gains in importance.

2.2.3.3 The power dimension

The use of digital technologies affect the links between the 'local' and the 'remote'. As Dourish et al. (2007, p. 427) state, "the availability of wireless networking, whether for cellular telephony, digital communication, radio frequency identification, product tracking, or environmental monitoring, imposes a new set of globalism through which the local can be read, thereby connecting one to a range of diffuse infrastructures, and, through them, to a set of practices and a set of people brought instantly `into range' if not directly into view". Thus, in studying urban development, critical geographers have long focused on the social linkages that go beyond a location but exert influence there nevertheless through the idea of *power geometries* (Massey 1993). Furthermore, the influence of post-structuralist thought means that there has been a change in the view of geographic space in which it becomes seen no longer as a 'container' for social relations but in fact a component that is an essential part of human relations and that these relations may change and effect each other respectively (Murdoch 2006).

Discussing power over land, Crampton et al. (2007) point to the work of Foucault, who saw power, knowledge, and space as intrinsically related. According to Foucault, ownership of space is an outcome embedded within past social relations drawing attention to the relations amongst actors controlling and using space: "the things, in this sense, with which government is to be concerned are in fact men, but *men in their relations*, their links, their imbrications with those things that are wealth, resources, means of subsistence, the territory with its specific qualities, climate, irrigation, fertility and so on […] what counts is essentially this complex of men and things; property and territory are merely one of its variables (italics added)" (Crampton and Elden 2007, p. 7). Here Castells pointed out that *meaning* may be found in particular places, while *functionality, wealth, and power* are defined as part of *flows* and in other words are the social relations across various places (Castells 2010).

Within the post-modernist work of Foucault, the need for tracing these linkages has been drawn out to examine spatial outcomes in cities (Healey 1999; Boonstra and Boelens 2011). This focus contributes to a new attention to *processes of spatial emergence* (Murdoch 2006). In light of the digitalisation of urban spaces, this requires study of the practices of accessing information related to urban development; and it requires an understanding of the possible 'power' of permanent residents within particular local spaces. In regard to the latter, research on participatory geographic information systems (PGIS) has discussed the risks that external agents might seek to re-appropriate locally collected indigenous information towards their own agenda (Rambaldi et al. 2006; Sieber 2006).

2.2.4 Section conclusion

In summary, literature in planning, geography, sociology, and computer science describes the 'city' as a dynamic and unbounded network — hinting at its parallel processes of different temporalities and spatial extents. This leads to the view of urban development as a relational process of interaction(s) amongst heterogeneous actor groups, information communication technologies, and physical space itself. It requires consideration of *space* as a social infrastructure (Dourish and Bell 2007) to the social relations within which places are embedded (Healey 1999). Key points are summarised in Figure 3.

Dimension	Key points
Socio-technical systems dimension	• Urbanism involves the roll-out of hard infrastructures (Graham et al., 2001). • Digital infrastructures emerge as a set (or sets) of ICTs involved in the achievement of a societal goal. • Physical space presents the socio-cultural substrate for social interactions mediated by these new digital infrastructures (Dourish et al., 2007)
Time-space dimension	• The content of the city is constantly evolving from the many social interactions in space and time. • There are different temporalities from the durability of physical structures to the fleetingness of digital data.
Power dimension	• Digital infrastructures mediate access across different social settings, sites, and groups. New links are provided between what is local and what is global changing established networks of power. • Tracing of power relations is important to understand spatial outcomes achieved through digital mediation (suggested in Boonstra et al., 2011)

Figure 3: Key points across the three dimensions of the network view of cities

Large-scale technical interventions (as presented in Figure 2), and indeed any form of participation in urban development, need to face the set of existing institutions, technologies, as well as the needs of citizens in *place*. From a functional perspective, Townsend (2000) suggests that digital infrastructures' organic data of urban activity could supplement costly city council surveys. However, researchers in computer science have avoided engaging with and deconstructing the institutional implication of such technological possibilities. Critical engagement is lacking in the technology implementation projects of city councils and the agenda of commercial vendors that supply those technologies (Hollands 2008). While digital technologies provide the *means* to better enact the relational processes leading to spatial outcomes, new forms of participation within urban space remain convoluted in power struggles, across time and space, and involving different technological systems. Power struggles arise from various actors with competing expectations towards, gains from, and requirements for access to urban data. These power struggles occur across actors often exerting power regardless of physical distance and, where infrastructures with profound revision to practices in local government are concerned, with considerable long-term implications. Conceptually, those who can shape standards, practices, technologies to their favour today may gain significantly in the future. Methodologically, the challenge is thus to understand the institutional factors that, if changed, would enable new forms of participation that are open to local actors and balance their territorial needs with those of the top-down perspective of, for example, government actors.

2.3 Participation in urban development

This part of the literature review focuses on urban planning as a *functional means*, through which spatial outcomes in urban development are controlled, and the common ICTs and common modes of citizen participation therein. Researchers in urban computing have used planning as a discipline to critique narratives of city infrastructures (Staffans and Horelli 2014; Weise, Hardy, Agarwal, Coulton, Friday and Chiasson 2012b) and pointed to the possibility of 'expanded urban planning' in which the institutional processes[23], activities, and ICTs involved in planning become a vehicle to foster the development of urban technical interventions (Staffans and Horelli 2014). In this strand, planning is viewed as "participatory knowledge building and coordination process which strives to pull together scattered information from digital and non-digital sources" (Staffans and Horelli 2014, p. 4). As Inch (2014) shows in his discussion of 'end-of-the-pipe' citizen groups, planning is entrenched in power struggles that always relate to the materiality, people, and technologies across a geography. In this review, planning is therefore seen as a discipline that *intervenes* in the *effects* of the flows of capital, information, goods, and people that constitute and project functionality, wealth, and power.

2.3.1 Definition of urban planning

Urban planning is an established domain of political decision making for *directing* urban development (Kubicek 2010). As part of urban management, its goals are "concerned with the policies, *plans*, programs, and practices that seek to ensure that population growth is matched by access to basic infrastructure, shelter, and employment (italics added)" (Davey 1993, p. iv). Seeking to control free market forces, urban planning *intervenes* in development (in other words, by enabling or inhibiting alterations to the urban space) through guiding criteria detailed in forward-looking plans and by accepting or rejecting development proposals (Banai 2012). From a local government perspective, planning provides means to control spatial outcomes in urban development. It uses various ICTs for problem solving and citizen participation therein (Bugs 2012).

---

[23] Here, institutions are defined as a set of rules reflected in recurring social practices (Hess and Ostrom 2011; Ostrom 2005). Hence, it includes both 'established' institutions in which many rules are codified and 'emergent' institutions (of community groups) where this is less the case. Planning is a *formal* political process with a set of defined rules that create organisational actors and processes. Procedural rules set forth in laws present the guide lines for municipal planners, part of the *established institutions* in planning.

Urban planning is constituted of a range of specialisms and disciplines. For the linkages between the physical and virtual spaces through practices mediated by digital infrastructures, *spatial planning* and more specifically the sub-branch of *land-use planning* is relevant. Land-use planning is concerned with future actions related to land[24] (Bohøj et al. 2011). Furthermore, the planning function in English local authorities differentiates between *planning policy* departments, which involves officers looking into the long-term development of a geographic area, and *development control* departments, which involves officers who assess development projects and approve or reject them based on a number of criteria.

2.3.2 Institutional controls — urban planning in the UK

The institutional context to participation in planning is presented by planning laws, national policies, sets of specialised terminologies and ICTs, as well as various (government) organisations and individuals implementing these laws through interaction. This may be referred to as a "planning system". As part of government, local planning authorities have a monopoly over the public process to *implement* official planning policies.

In the UK, the Town and Country Planning Act (1947) remains a foundation for the planning system to date (Anon n.d.). Many of the criteria[25] used to assess development proposals (representative of future spatial outcomes) are detailed within planning policy documents (referred to as "plans"). In the UK, local planning authorities (LPAs) are legally obliged to prepare a local plan for their area of authority. Public officers, mostly planners, working for local authorities prepare and draft *plans* on behalf of the citizens in their area of responsibility. Plans are costly and complex documents to develop (Doak and Parker 2005). They "must reconcile immediate problems with future expectations" (Banai 2012) and balance the competing aspirations that various citizens may have for a place (Healey 1999).

Unlike development projects that are financed, concrete, tangible suggestions, plans and the policies within them are vague and intangible; thus usually less conducive to generating public interest compared to development projects. Once adopted, the plan

[24] Planning does not necessarily need to codify specific locations for development but may also follow a criteria-based approach to control spatial outcomes, such as by agreeing standards that apply to different development types (e.g. maximum height, maximum size, etc.)

[25] The types of possible criteria are of lesser relevance to my work. They may for instance include design guidelines, building standard requirements, or type of development.

assumes legal power in the subsequent assessment of development proposals. While the documents are prepared by planners across the UK's 326 local planning authorities, they have to correspond to a set of national development policies, and a range of process requirements. This is enforced by an assessment of each plan and the process through which it was developed by a national planning inspector (Cullingworth and Nadin 2006). It may take a few years for a plan document to be approved (see CHAPTER 6).

Over the years, English planning laws have incorporated greater levels of public involvement through regional devolution. Since 2004, there has been an emphasis on "community strategies" (Baker et al. 2010) and partnerships (Doak and Parker 2005). Local participation was further enhanced with the introduction of neighbourhood planning[26] (Parker et al. 2014), and articulation of participation opportunities in compulsory documents, such as a Statement of Community Involvement (SCI)[27] (Localism Act, 2011).

Based on Cullingworth et al. (2006), the process for *making* plans is illustrated in a simplified, recursive process below (see Figure 4). The figure highlights key stages as well as opportunities for citizen participation in the process.

---

[26] Introduced with the Localism Bill of 2011, Neighbourhood Plans present another layer of plans that can be developed by community group or parish council for instance.

[27] However, a set of 21 SCI was found to be broad, generic, and using complicated terminology; they conclude that SCIs failed to deliver "innovative practices" and new approaches to participation (Baker et al. 2010).

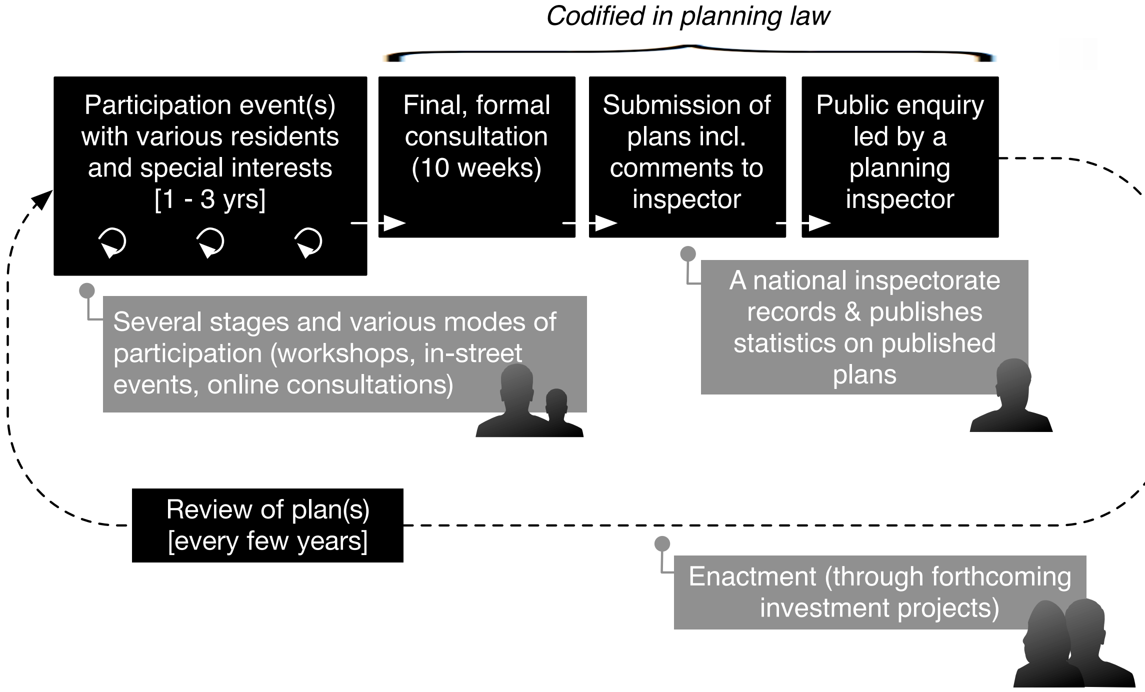


Figure 4: High-level cycle for preparing urban plans (adapted from Cullingworth et al. 2006)

2.3.3 Challenges for citizen participation in the UK

As a complex institutional process, participation in the preparation of plans confronts the dimensions of the network view of cities (see section 2.2). For example, the timing of building proposals by developers can conflict with the lengthy development of a plan. Likewise, the development of a plan may be overtaken by changes in the economic context and government policies. In practice, many local development plans are out of date, only one in seven corresponds to national government requirements (Dunton 2014). A lack of criteria and guidelines can result in the approval of development proposals that would otherwise be seen as unfit.

In the UK, national government and national lobby groups exert a strong influence over local choices (Healey 1999). The Royal Town Planning Institute called for a re-emphasis of geography to assess the effects that policies have on various *places* (Royal Town Planning Institute 2014). To date, the introduction of neighbourhood planning supports a trend towards "localism" and local self-organisation as it gives neighbourhood forums, parish councils and other local bodies the authority to draft plans for their area (Parker et al. 2014). While still controlled by compliance to national policies, neighbourhood planning can be seen as a step towards the re-emphasis of localities, but add to the complexity of controlling spatial outcomes.

The UK urban planning system requires fact-based "evidence" to support choices and options in plans (Cullingworth and Nadin 2006) which may act as a self-imposed barrier to many alternative styles of participation. Problematically, anecdotal stories may be rejected in favour of data gained from systematic studies (Kingston 2002) although local stories, experiential knowledge, and anecdotes are an important source of insight that local residents can contribute (Innes 1998; F. Fischer 2000). Due to the quasi-legal process and requirements for evidence, small but well organised minorities or professional individuals and group actors could overpower poorly organised majorities (Arnstein 1969).

Debating the *state* of citizen participation in planning in the UK, using twenty 'participant stories' in the planning system of Scotland, Inch (2014) shows that poor participation in planning reflects normative participation theories. Working *with* (on the basis of mutual understanding) or *against* the institution (in community campaigning), participation caused anxiety and often resulted in disappointment. On the practical level the author calls for better procedural rules that can "care for the citizens who (planning processes) summon while fully and fairly engaging the political energies they bring". It is suggested that in a pro-growth planning culture, the opportunities for such engagement are often perceived as too risky. In Inch (2014)'s article, the responsibility for "full and fair" citizen engagement is shifted to the planners to "recognise and find ways to channel the political energies that planning issues generate". Taken together, these factors provide constraints to meaningful citizen participation.

2.3.4 Established forms of participation in planning

In the late 20th century, the public hearing as well as the traditional ‘‘review & comment" (consultation) process were the principal ways in which citizen participation was considered (Innes and Booher 2004). On the Internet, online public consultation has become a key forms of citizen participation in established institutional processes. In online consultations, planners give citizens an opportunity to comment on a draft of policies authored by them on behalf of the public. In the UK, municipal planners are required to invite the public to comment on final document drafts over a six-week period, make physical copies available in libraries, publish a notice on their website and local newspapers, and notify any involved individuals (Doak and Parker 2005).

Established forms of participation, such as the online consultation or the public hearing, often pitched opposing groups against each other (Innes and Booher 2004) and, as Baker et al. (2010, p. 581) suggest, "(they) tend to encourage community members and stakeholders to 'come to us' and view plans and proposals at local authority specified locations" instead of "going to people". In participation events, it is not guaranteed that the citizen's input has a direct impact, as the act of participation remains confined to premises established by the political institution (Boonstra and Boelens 2011). Participation activities may become a tick-box exercise ('tokenism') measured by the number of participants rather than the quality of the output (Arnstein 1969).

2.3.4.1 Institutional influences on the forms of participation

Planners in the municipal authority serve as "information brokers" setting agendas for meetings, suggesting decisions, and shaping requirements (Forester 1989). In participation events, they draw on specific domain knowledge, a language that can exclude those not familiar with it (F. Fischer 2000). Planning officers tailor the forms of participation to the local context. Planners are at the centre of reforms to planning systems, which internationally shapes the influence given to citizens in planning outcomes, the structural (in)equalities of who gets involved, and, consequently, the relationship between the state and its people (Brownill and Carpenter 2007).

As Tait (2002) illustrates in an actor-network study of two cases of plan development in the UK, the level and degree of participation offered in each case was enacted differently by the planners within the local council. Planners operationalised national policies and planning laws and their attitudes had a significant effect on the nature of citizen involvement within the same institutional frameworks. From the point of view of the established institution, planners face the challenge to *sustain* participation over a long time frame, maintain the *quality* of participation interaction, *integrate* the contents of different planning documents and their evidence, and finally *mobilise the resources* that are required for all of this (Doak and Parker 2005).

A study by Falleth et al. (2011) of 100 development plans and associated survey of planners, developers, local communities and politicians in Norway shows that only five out of the hundred plans involved citizens beyond the legal requirements. Developers consider community participation as less important than politicians and municipal planners. Community involvement often happens later after an "informal" stage in the form of consultations on decisions already made. 17% of the developers thought that community input did not change much and only 5% of community organisations indicated that they had an ability to influence changes in the plans. While planners and developers talk extensively prior to consultations, the main contact with public participants are politicians, who are involved at a later stage. Politicians, while appreciating the importance of public participation, often feel bound to the negotiations between developers and local planners. Their critique of existing practice implies that too few opportunities for participation were organised locally (meaning close to the planned interventions) and too late, when most decisions had already been made.

2.3.4.2 The value of participation

Scholars and practitioners in urban planning offer diverging opinions as to the value of participation. To some extent it is difficult to evaluate and heavily depends on the context in which participation opportunities were organised.

Participation has been recognised as a normative good for fostering democratic principles of freedom of expression (Cullingworth and Nadin 2006; Innes and Booher 2010; Forester 1989; Boonstra and Boelens 2011). Participation is said to legitimise decisions and improve outcomes (F. Fischer 2000). Boonstra et al. (2011) argued that self-organisation by community groups passionate about a particular issue can support social resilience. In that sense, a participatory planning system cultivates a democratic civil society and leads to an “adaptive, and self-organising polity” (Innes and Booher 2004).

There are limits to participation, for example, when technical expertise is required (F. Fischer 2000). The highest level of interactivity is not automatically the best option at all times for every participant (McCall and Dunn 2012). For involving non-experts in complex decisions, Rittel et al. (1973, p. 169) suggested that "substitut(ion of) the expert professional judgement for those of contending political groups may make the rationales and the repercussions more explicit, but it would not necessarily make the outcomes better". This review established that it is useful to differentiate between different levels of participation according to the stage in the planning process and the stakeholder group.

2.3.4.3 Role of information in planning

There are parallels in the understanding of information in technology-led interventions in planning now and its use in information systems for planning in the past. To affect urban dynamics, collecting data from the real world was assumed to be required to "gain a better understanding of the environment" (Han and Kim 1989). This logic is apparent in the case of traffic monitoring by studying the mobility traces of taxicabs (Zheng et al. 2011) and the other three examples that were provided at the outset in Figure 2. For example, to avoid traffic gridlocks, it is argued, the availability of high-quality, real-time data may lead to better planning outcomes as it increases the level of insight into its causes (compare Webber 1965). Similarly, much of the early use of geographic information systems for community empowerment was constrained to expert users' attempts to generate quantifiable information about properties and entities in and across geographic space more easily (Talen 2000).

Since interventions in urban development lack a universally agreeable set of desired outcomes, they are ill-suited to positivist analysis (Rittel and Webber 1973). Firstly, the framing of the problem depends on understanding gained by the stakeholders as they unpick the perceived problem. Secondly, once information is collected it “frames, or in other words limits the available choices in the first place" (Innes and Booher 2010). Thus assumptions are continuously evolving[28]. Therefore, information is viewed in this thesis as depending on pre-existing framing and rationales. Gathering information is a first step as data requires analysis to establish outcomes, which require communication and participation by participants. Information in planning is not solely scientific but incorporates individual experience and intuition, personal stories to help update and correct common belief, images and representation (artefacts) (Innes 1998).

From a computing interaction perspective, participation in urban planning can be viewed as a process of collection, processing of information ("*digital media*") and the organisation of digital facilities to enable it (Saad-Sulonen 2012). In this view, the planning process is an information system linked by various ICTs involving participants across various sites, such as (?) social settings. Saad-Sulonen (2012) suggest that planners should extend citizen participation beyond the substantive planning issues to the *organisation* of participation and ICTs involved. For the collaboration and participation, information in planning falls into three categories. First, the provision of information such as the dissemination of outcomes of planning (at present, the most common form of information dissemination done by planners), information on opportunities for participation, and thirdly, information on the process and guidelines by which outcomes are achieved[29] (Saad-Sulonen 2012).

2.3.5 ICTs for citizen participation in urban planning

A growing number of interactions in planning are mediated by digital ICTs (Saad-Sulonen 2012; Seltzer and Mahmoudi 2013). In 2012, two thirds of the 600 million interactions between citizens and local authorities in England came through digital channels (Local Government Association 2015). As source of power, (digital) information complements money and land; and it is increasingly "flowing through interconnected computers" (F. Fischer 2000, p. 11). Hence, access to, and control over information on urban development issues gain importance (compare Kelley 2014; M. Graham et al. 2013). In this review, ICTs involved in urban planning are seen as part of the *means* by and through which *outcomes* are achieved. While the planning discipline uses a wide range of specialised technologies (Geertman and Stillwell 2009), the review focuses on those digital technologies that are employed for citizen participation. This literature review emphasises

[28] Healey (1999) refers to the existence of 'different readings of space'

[29] In the UK and in principle, this is detailed in the "Statement for Community Involvement" prepared by planners (Baker et al. 2010).

the use of *geographic information systems* that store, manage and make use of data about *locations.*

2.3.5.1 Planning support systems

Within the domain of urban planning a wide range of specialised ICTs were developed and are referred to as planning support systems (PPS). These fall into four categories of 'database management systems' for data gathering, processing, basic statistics and analytics; geographic information systems (GIS) for gathering, processing, and analysis of geospatial data; decision support systems for special decision making problems that draw on various planning databases; and expert systems, digital knowledge bases similar to Wikipedia for planning (Han and Kim 1989). Usually they are built for planning professionals. The main obstacles that limit the widespread use of PPS are their inaccessibility to less technology savvy individuals, the difficulty to represent "opinions, beliefs, perceptions, values" of participants and combining that with quantitative data (Geertman and Stillwell 2009, p. 11). Systems that are used for collating, storing, and using location data, such as geographic information systems, also originate within the planning discipline (Talen 2000).

Kingston (2002) associated static web pages, that serve information to the public, and online opinion surveys, for one-way feedback, with degrees of tokenism. "Online participatory geographic information systems"[30], on which citizens may leave comments on a map, on the other hand, were associated with the most deliberative mode of participation. A study of practice shows that while public GIS (PGIS) applications were promoted as two-way-communication in an institutional context (within public administration), they often did not deliver on this promise and were applied as a one-way communication channel instead (Bugs et al. 2010). This topic will be further covered in CHAPTER 7.

There is an overlap between PPS and geographic information systems (GIS), but the latter has a broader range of applications that go beyond planning support (Vonk et al. 2007). Early versions of GIS were similarly conceived as expert systems (Talen 2000; Innes and Simpson 1993). Furthermore, traditional planning support systems were not built to handle the real-time user-generated content found on geo-social websites like FourSquare and Yelp[31]. This puts those 'old' technologies in stark contrast with geospatial applications

---

[30] Kingston is a geographer and urban planning scholar. He is widely known for his work on participatory mapping exercises to facilitate participation in planning (Kingston et al. 2000).

[31] Such aggregation technologies are at an early stage of development.

online (such as Google Maps, FourSquare, Yelp), which individuals use on a daily basis and which rely on citizen-contributed content and reuse. The fact that such platforms were not intended to support institutional forms of planning, presents a gap between the fields of specialised urban planning support systems and that of the more ubiquitous location-based services (see next section).

An interesting middle ground comes from the community-application of geospatial technologies (see Wong and Chua 2001; Leitner et al. 2002). Under the banner of 'bottom-up GIS' (Talen 2000) or participation GIS (McCall and Dunn 2012) the application of GIS in a non-technical manner was explored. A small number of scholars from interdisciplinary backgrounds have begun to fill this gap with modern approaches that are reminiscent of web GIS or location-based services on mobile devices (e.g. Saad-Sulonen 2012; Bohøj et al. 2011; Nuojua 2010). Section 2.3.5 gives examples from the literature relevant to new forms of participation.

2.3.5.2 Participatory GIS and geospatial data

Online platforms that combine such user-generated content with other spatial data sources are considered as a (r)evolution for online content creation (S. Graham 2004). Any distinction from specialist geographic information systems (GIS)[32] for planners dissolves (Dunn 2007). This has led to calls for connecting spatial analysis, remote sensing (from mobile phone data), and Internet-based mapping to "improve urban planning by fostering cooperation between urban planners and multiple stakeholders" (Y. Shin and D.-H. Shin 2012). In the domain of urban informatics, Foth et al. (2011) identified the availability of open-accessible geospatial technologies as one of the key enablers for the field.

Relevant technical projects, that sought to provide users with the option to associate their input to spatial features on a map, are found across a number of domains, including GIS, participatory planning, and increasingly computer science[33]. Table 2 compares eight selected projects in chronological order, according to the technology used, the lead organisation responsible for their development, and the geographical scope of the intervention. Subsequent paragraphs draw on these examples.

---

[32] Traditionally, geographic information systems are "a computer environment used to collect, store, manipulate, analyse, produce and disseminate geographic information" (Bugs 2012).

[33] Since these projects inadvertently seek to facilitate collaboration and coordination across a range of actors, physical, and social settings, the underlying technologies can be grouped under the heading of "new media technologies" (compare de Lange and de Waal 2013).

Project	Technology	Ownership*	Geographic scope
Planning for Real (Kingston et al., 2000)	Bespoke online geographic information system	Research-supported & community-led	Town
Bottom-up GIS (Talen, 2000)	Customised ArcGIS	Research-led & multiple cities	Neighbourhood
NKCA (Rattray, 2006)	Bespoke spatial data platform (USD 1.4m)	Research-led & multiple communities	Region
ArguMaps (Rinner at al., 2009)	also mashup-based	Research-led	Town
WebMapMedia (Nonunja et al., 2010)	mashup based on Google Maps	Research-led	Town, rural
Open311 system (2011 - now)	Open-source platform	Research-led & multiple cities	City
Urban mediator (Saad-Sulonen, 2012)	APIs for integration to 3rd party sites	Research-led & local authority	City
Mobile democracy (Bohøj et al., 2011)	Desktop platform with mobile access	Research-led & particular communities	Town, rural

Table 2: Projects mentioned in this literature review

In the planning domain, technical interventions that sought to make mapping available to communities often remained hampered in their technical approach and rooting in spatial planning (Talen 2000; Dunn 2007). Delivery of these systems to a wide audience remained challenging for technical reasons, too. Early systems depended on desktop clients, such as in the bottom-up GIS project (Talen 2000), or used experimental set-ups online (Rinner and Bird 2009) and bespoke software (Kingston et al. 2000). Complex to maintain and use, early systems often remained one-off interventions (Rinner 1999; Yu and Cai 2009; Kingston et al. 2000), for example, for community group advocacy (Rambaldi et al. 2006).

The capacity of the Internet as a distribution medium was recognised early, but could not be fully utilised until much later. For example, Rattray et al. (2006) demonstrated that a distributed web-hosted GIS can be a viable option to expand access to mapping functionalities for various non-expert individuals and community organisations. Advantages were the lower operational costs from hosting online, public accessibility, novel forms of interactivity and potential for sharing geographic data. Adoption barriers (such as bespoke complicated set-ups) are being increasingly overcome by the provisioning of the technology more permanently online (Leitner et al. 2002). Participatory GIS were often thought of as expert tools which is why Talen et al. (2000) invested much time and effort to co-configure a desktop GIS with a community group instead. Arguably, these experiments did not scale their functionality beyond a small number of application sites and settings and they thus did not depend on an established infrastructure.

Projects like ArguMaps (Rinner 1999) link debate to physical space, it combined a discussion log with a geographical map. Helping a small town in the North of the UK to engage in spatial planning, Kingston et al. (2000) successfully embedded a web GIS into a participatory planning initiative. It extended the participation process beyond a workshop to citizens in remote locations. Overall, 127 users contributed by flagging issues on a map and shared those with workshop participants (Kingston et al. 2000). Location-based systems or geospatial technologies adapted for the use in planning faced challenges of representation of soft knowledge, including concepts such as well-being, safety and accessibility — what works and what does not work in a place (Kingston et al. 2000).

Early planning-focused studies do not yet show the infrastructural capacity of such mapping platforms. For example, Yu et al. (2009) describe a map-based online forum but failed to test their idea in a real-life scenario. Following a similar approach, Rinner et al. (2009) made a prototype work, but only attracted contributions from seventeen citizens in a short experimental deployment. While they indicated that the tool helped to generate feedback, participants did not (as hoped) use the mapping functionality to geo-reference their chat conversation. A number of factors contributed to this outcome, such as the poor timing of the study (a major participation activity took place a month before) as well as the poor implementation of the user interface[34], so possibly it wasn't useful. In this configuration, using maps for participation appeared to be a bad idea.

The release of the Google Maps platform in 2007, and the availability of mobile Internet, have contributed to many new projects in computer science disciplines. Work began to reveal the capacity of maps in supporting alternative geographies through user-annotated maps (Goodchild 2009). For example, a study of online participation in local planning through mobile phones in Norway demonstrated that citizens enjoyed participating through making minimal, specific, low-commitment contributions on the mobile device (Nuojua 2010). Nuojua (2010) used a web mashup based on Google Maps that overlaid comments from citizens' Nokia phones onto a map of the area. Bohøj et al. (2011) describe a system they call Mobile Democracy to enable citizens to comment on their environment from both a smartphone application or a desktop browser. Mobile Democracy is similar to modern location-based services capable of being used from a variety of devices. Location-based commenting on mobile devices, they suggest, can lead to greater quality of participation as citizens can participate directly from a place. It did not

[34] As mentioned in the final section, researchers have noted that a user friendly interface is critical (Albrecht 2006)

require citizens to act out of context as is usually the case in online participation on a desktop computer.

However, when Korn et al. (2012) embedded Mobile Democracy in the context of a participation initiative for a nature reserve park, only 20 users contributed information and thus large-scale participation through such method remains unproven. While GIS is used by most local authorities in the UK, continuing uncertainty remains how GIS might truly disrupt established participation(Nuojua 2010). It is not clear how a GIS should be designed to benefit both planners and citizens (Bugs 2012) and there are many data ownership issues (Kingston et al. 2000).

2.3.6 Section conclusion

Scholars critiqued the suitability of established planning processes to engage citizens (Healey 1999; Innes and Booher 2004; Boonstra and Boelens 2011). Participation in urban planning is complex and if implemented poorly it can decrease opportunities for future participation. Specifically in the UK, strong national government control and strength of national lobby groups mean that the role of place and the decision authority of its occupants are diminished. Critiques of existing institutional engagement (as delivered by local authorities) may be summarised in the notion “too little locally too late” (that is after important decisions were already taken). However, planning literature, technological capabilities, and changes to UK law provide opportunities for future interventions to enhance the self-organisation of community groups technologically, necessarily requiring revision to established institutional processes.

Furthermore, work on planning support systems (PSS), including geographic information systems (GIS), has evolved alongside the explosion in geo-social and collaborative platforms on the Internet that have been linked to ‘new media’ (see de Lange et al., 2013). While usability and deliverability of GIS-like systems have improved, difficulties remain in combining ‘empirical evidence’ (for use in planning) with citizen-generated information. Online-based geospatial platforms indicate opportunities for new forms of participation in planning. Their capacity in augmenting public choices remains hampered by challenges in embedding those tools within existing institutional processes. This may limit the transparency of urban planning processes and the capacity of citizens to engage.

2.4 New forms of participation in urban development

This final part of the literature review returns to the modes of organising participation that may support a devolution of decision authority towards groups beyond formal institutions. Examples of academic projects reconstructing social interaction in relation to physical space (see Figure 2) and the range of projects introducing geospatial technologies into planning (see Table 2) indicated how ICTs may contribute to a more responsive and interactive urban environment. So far, there has been no discussion as to how such capacities may be *governed* and how they fit to *existing processes* in planning. This part first reviews calls for new forms of participation. Secondly, it analyses three dimensions to Internet-based collaborative technologies that are of likely relevance. Thirdly, it elaborates on forms of decision making that call for 'distributed' problem solving, such as self-organisation of planning by community groups (Boonstra and Boelens 2011), the network publics (Bruns 2008), and peer-production (Bryant et al. 2005; Benkler 2007). By distributed decision making, this literature review aligns with the definition by Surowiecki (2005, p. 70), who described it as a situation in which "power does not fully reside in one central location, and many of the important decisions are made by individuals based on their own local and specific knowledge rather than by an omniscient or foreseeing planner".

2.4.1 Calls for 'new' forms of participation

In 1965, Webber et al. (1965) reported that higher education levels contributed to complex decision situations as ad-hoc citizen groups took greater influence over spatial planning outcomes. Innes et al. (2010) suggest that a growing adversarial context of planning attributed to the ethnic diversity of local communities and the perceived 'loss of identity' of place[35], need to be compensated through collaborative dialogue on the interpretation of matters of concern shared by different individuals and groups. In planning, they note, interdisciplinary actors disrupt the 'dualism' between the institution (such as local authorities) and the wider civil society. This distinction used to be a key element through which planners authorised their otherwise complex task.

Socio-political changes and the availability of digital technology calls for innovative new solutions to participation in planning. They should follow a citizen-centric approach (Baker et al. 2010) beyond participation constrained by governmental actors and governments' terms (Boonstra and Boelens 2011). Boonstra et al. (2011) argued that communities[36] should be encouraged to 'self-organise' and take matters into their own

[35] The notion of place is further articulated in a later chapter. Places are parts of geographic space with meaning associated with them. See glossary.

[36] The concept of 'community' has been critiqued for being too focused on "small scale and local ways of life". De Lange et al. (2013) used the concept of "networked publics" that better captures that individuals grouping around "shared matters of concern" are diverse in social status, location, cultural

hands, an approach that focuses on continuity (flattening of hierarchies) and decentralisation of decision authority (see Brownill and Carpenter 2007). Contrary to Boonstra et al. (2011), who considered various institutional regimes in different European countries, the question in this review is on how self-organisation practices may be supported by the application of technical interventions.

2.4.2 Revised modes of organising participation

Digital infrastructures may advance decentralised problem solving by broadening the reach of collaborative exchanges on multiple matters of concern in parallel through peer-evaluation (Brabham 2009). For the goal of technical interventions in planning and elsewhere, several researchers from within computer science suggested 'crowdsourcing' or 'peer production' as forms of participation that depend on the power of the many (Townsend 2000; Brabham 2009).

Two popular terms were defined in the literature.

First, the term 'crowdsourcing[37]' demarcates an activity, or call for action for participation to a wide audience online. Howe (2006) defined it as "the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined large network of people in the form of an open call" (Howe 2006). Elsewhere it was described as an all-purpose collaborative problem-solving method at a global scale for the 21st century (Doan et al. 2011) through tools that "enlist a crowd of users to explicitly collaborate to build a long-lasting artefact beneficial to the whole community". Crowdsourcing includes two fundamental assumptions that go against established forms of participation (such as online consultations): First of all, it assumes the existence of a technical infrastructure that enables participation of most citizens within a community. It assumes that bottom-up distributed participation leads to the fostering of new ideas through the crowd, but it retains the role of the planner as a 'central' decision maker.

On the other hand, Wikipedia and Linux, examples of 'peer production', lack an authority that owns outputs and directs citizen contributions (Benkler 2007). Peer-produced content on Wikipedia has become the largest body of knowledge humankind has

---

identify and fleeting in their organisation. This argument is accepted in this thesis, however due to the rural character of the study areas included in this thesis, the term 'community' (with its "small scale and local ways of life") is applicable.

[37] This definition does not include crowdfunding. Crowdfunding is different in that it does not require the integration of contributions into a collective output directly.

co-produced to date (Bryant et al. 2005) and it has been described as being inherently incomplete by design (Garud et al. 2008). Peer-production is guided by the creativity of contributors as well as by the social rules that users agree on and co-create. While it is said that Linux and Wikipedia have engrained social structures with a small circle of influential users in the centre that have great capacities in making policies, as well as strong 'ground rules' (Bryant et al. 2005), the approach and organisation of open-source peer-production is complementary to the concept of self-organisation suggested by Boonstra (2011). Using new media technologies in the urban context, De Lange et al (2012) argued that organising participation "networked peer production" can avoid the fallacy of approaching participation models as either parochial bottom-up or patriarchal top-down.

The discussion on crowdsourcing is strikingly similar to the approach to participation that planners already take (Seltzer and Mahmoudi 2013; Brabham 2009). For example, Brabham (2009, p. 255) argued, "crowdsourcing the public participation process [...] does not seem very different from participatory land-use mapping, participatory 3-D modelling, 'chip games[38]', PPGIS, or Web-based urban information-gathering networks and mapping activities. It is the process *whereby the everyday citizens who design solutions also vet those solutions that makes crowdsourcing distinct from these other methods*." (italics added). Following the principles in crowdsourcing, participation activities of planners implied a transfer in ownership of the outcome of participation to the organiser. It leaves the coordination role and the "ownership" over the final artefact in the hands of the established institution.

2.4.3 Dimensions of technical interventions for new forms of participation

Continuing the focus on aspects of technical interventions, three dimensions of technology-supported modes of participation are introduced that are essential to urban informatics. The physical — virtual linkage dimension argues that the physical context of the user community is important as planning commonly relates to locations in physical space. The individual to collective output dimension touches on the challenge to transform individual contributions into useful collective results. Lastly, the dimension of encouraging voluntary participation accounts for the fact that participation in planning, as in online services, is voluntary and thus requires appropriate incentives for interaction.

[38] CHAPTER 4 describes how planners applied a 'chip game' to evaluate land allocation preferences with poker chips.

2.4.3.1 Linking offline and online space(s)

For human-computer interactions, physical space (in its geographical sense) provides a brittle socio-cultural infrastructure in which the diversity of communities should be gently enhanced as opposed to smoothed out by technological interventions (Dourish and Bell 2007). In this overlap of the physical and the virtual, technical interventions aimed at fostering civic engagement should serve three aspects: as trust and community-building tools, as discussion spaces for discussing alternative choices, and as information spaces to support the sharing of information (Bohøj et al. 2011).

For the success of geospatial platforms, "by definition, the public requires a physical bounding (e.g., a city or a neighbourhood)" (Sieber 2006, p. 496). In location-based services, maps link activity online and the social activities in and with the physical space (Panciera et al. 2010). For example, on a platform for sharing cycle routes in Illinois (USA), contributors preferred to select areas with which they were familiar through an online map. Contributions could be steered online by featuring areas on the map that had received fewer annotations. Additionally, Alt et al. (2010) found that study participants preferred to solve tasks that were related to the participants' popular locations or in their physical proximity. For example, using a location-based system for tasks that require physical presence (such as taking a photo of a building). Brabham (2012) suggests that targeting the local audience through online means only is not sufficient in encouraging their participation online; successful local-based initiatives depend on involving local citizens through off-line events, too. Conversely, promoting the platform in popular places face-to-face would be useful in generating activity online (Panciera et al. 2010).

Places are embedded in power geometries (Healey 2006) and, thus, participation that spans the local-to-global and physical-virtual contexts may affect this balance. In an online-hosted competition to design bus stop shelters for Salt Lake City (USA) that registered 3,100 unique users and 260 design proposals, Brabham (2012) observed that a number of international contestants entered the competition. Based on 15,000 votes, their winning contributions showed a higher degree of professionalism and crowded out local submissions. Brabham (2012) speculated whether votes by non-locals gave proper consideration to the area-specific circumstances. He suggested that, at least for the voting, votes of local citizens could be given greater weighting.

For systems that automatically analyse urban dynamics based on citizen-generated data on online-platforms, the risk of privacy evasion cannot be ignored. The context, and mode of the data is important: Citizens can either provide data voluntarily (as in the case of participatory sensing and user-generated content) or it can be inferred by statistical processes on data collected by a third party (World Economic Forum 2012). This comes with increasing perceived loss of control, thus "the more distant data gets from the awareness of an individual and the more intimate and predictive it becomes, the more it creates the sense of unease and suspicion. This loss of control and sense of intrusion could lead to disaffection and abandonment from the system altogether" (World Economic Forum 2012). For citizen-generated location data such inferences should be associated with explicitly permission by a citizen (Shilton 2012).

2.4.3.2 From individual to collective artefacts

Another challenge is to provide the context for meaningful participation. For open data, Kuk et al. (2011) found that data progresses through a series of stages that increase its reuse value. Different tasks (for example data cleaning, packaging into useful data products, integration into services) may be done by different citizens performing different actions[39] on the data. They found that data from its raw form is transformed to services in several intermediary steps in which social actors contribute to increase the "transactionability of data" into making a dataset useful or providing it as part of a digital service. Digital platforms could serve as distribution hubs supporting interlinking of datasets. They recognised a lack of measures for understanding the process of transforming open data sets into actionable services or data products.

A 'law' of online participation is that of the inherent inequality in the level of participation. Bruns (2008) described the dynamics of participation in new media (on social media and online blogging) as 'issue publics' in which citizens participate out of personal interest for particular matters of concern, such as a specific residential development. Online participation usually follows a skewed distribution so that it is unlikely that all citizens contribute equally: For example, from the perspective of core organisers of online communities, 25% of citizens may always free ride, a small group of people contribute, and a large majority contribute occasionally (Surowiecki 2005). Participation often relates to a power law distribution in which a minority of users provide most of the content, while the majority observes but does not contribute (Crowston et al. 2012).

The process from individual contributions to collective outcomes can be supported by enabling reuse of content. This may include the 'reuse' of previous answers to online questions (Salganik and Levy 2015). Content reuse implies drawing on previously collected data sets. It requires consideration of how long past content would be accessible. It brings up the question of content attribution, important in recognising ownership of the data items and appreciation of the source. Such data history was referred to as provenance

[39] For example, Burke et al. (2006) suggested different roles, such as initiators, evaluators, gatherers, analysts — a concept that was drawn on in the position paper (CHAPTER 3).

(Mejova et al. 2011). Sharing and reusing of information is essential as Mejova et al.'s (2011) work shows. Drawing on an organisational repository for presentation slides, they found that data reuse is commonplace. Perhaps not surprisingly, most individuals drew on information created previously by individuals in their social network (Mejova et al. 2011).

Lack of tools for data sharing limit the ability to reuse data. This is an issue in urban planning where data is held by different institutions (Carrera and Ferreira 2007). For data reuse and recombination, as far as spatial platforms are concerned, copyright issues with existing geographic data are a main hurdle (Kingston et al. 2000) as well as aggregation of data for "soft concepts", such as crime and community well-being (Talen 2000). Frequently, the local authority may not have suitable institutional processes, resources, and capabilities to maintain citizen-generated processes, where citizens initiate data collection for themselves (compare CHAPTER 7).

2.4.3.3 Motivating voluntary participation

Participation in planning, similar to participation in online content production, happens voluntarily. Self-organised planning assumes voluntary participation by community group members in the *establishment* of the terms and processes for the participation process itself (Boonstra and Boelens 2011). This is likely to demand a high coordination and cognitive effort from these participants. Many (process related) aspects can moderate the participation, for example, participation is influenced by personal interest, socio-demographic status, and the ease by which any mediating technology embedded in the call for participation can be used (Albrecht 2006).

In a political context, participation in online activities is influenced by the level of trust towards the participatory initiative (Kingston 2002). Before participating, citizens will consider whether they trust the peer group of other citizens involved, whether the organisers of the initiative use their contributions in accordance with expectations (e.g. data privacy and influence), and whether they believe that the organisers can disadvantage non-participants. Digital tools were said to discourage participation amongst financially disadvantaged and technologically less savvy participants, or those with a physical disability limiting their use of computers (Kingston 2002).

Meaningful feedback is an issue (Sun and Vassileva 2006). Rashid et al. (2006) in their experimentation of rating user contributions, found that participation could be increased if users are shown the value they add to a community they care about. In the context of an online video upload and reviewing portal, it was found that displaying figures such as the mean of contribution to users below the average increased their contributions by 530% while those above the rating did not change their contribution behaviour significantly (Chen et al. 2010). In the context of planning, participation may be supported by making contribution easy, for example, by highlighting areas on a map that have received a low number of user-contributions. This can help direct attention and motivate additional contributions by reducing the time and effort required to find such segments on the map.

Participation is more likely where the problem or issue has strong personal relevance: Nonnecke et al. (2000) studied non-participants (i.e. users who viewed content online but did not contribute content themselves) during a 12–week collection period on an online discussion forum. In their sample, they included twenty-two health-related (high personal relevance), ten ITC-related (less personal relevance), and ten particularly ‘large' discussion groups (Nonnecke and Preece 2000). 109 groups with 150,000 posts from 60,000 members were included in the analysis. The share of users consuming content without contributing content online was lower on health-related discussions (44% of all users) than for ICT-related discussions (nearly 90% of all users). Saad-Sulonen (2012) showed a successful case of community self-organisation that was facilitated by a traffic problem many local residents could identify with. Beyond that, payment, altruism to benefit somebody else, fun, gain in reputation (which may be relevant for local politics), and even coerced participation have all be observed in online communities (A. J. Quinn and Bederson 2010).

2.4.4 Towards self-organisation

Modes of participation in planning have come a long way from "consultation, via collaboration towards a sort of delegated management". Yet, Boonstra et al. (2011, p. 106) argue, even the most interactive forms of participation remain “within and therefore are also based on government regimes”. They fail to break cycles of lengthy consultation procedures, complex political hierarchies, and lack shared decision making. Based on Foucault (places being owned by different constituents and thus entangled "struggles over whose 'reading' of space should take priority"), participation should happen in self-organisation in that citizens emerge as voluntary participants in and self-initialising actors for multi-stakeholder resolution of topics they feel passionate about[40] (Boonstra and Boelens 2011). In each case institutional forms of self-organisation were found that transferred the authority to a local group to maintain and use a local resource, for example, in the case of business improvement districts, cooperative housing in Denmark,

---

[40] I do not intend to suggest that such localisation of participation would remove conflicts among actors within the system. Instead, it will *shift* responsibilities and conflicts to the place where they can hopefully be resolved more efficiently.

and Zwischennutzung[41] in Germany (Boonstra and Boelens 2011). Hence crowdsourcing with a single central authority, such as the planners, may poorly correspond with self-organisation of planning systems organised with strong contribution by community groups (compare Boonstra and Boelens 2011).

The 'smart city' is not solely a technological problem but rather a social and cultural one (Townsend 2013; Hollands 2008). Self-organisation, a process of communities resolving planning questions without guidance from a municipality (Boonstra and Boelens 2011), calls for adaptations in the organisation of *institutional* processes to accommodate such forms of participation. Therefore, it is a social/institutional problem to embed new forms of participation that results from a restructuring of hierarchies and roles. In terms of the digital technologies involved, self-organisation appears to call for a decentralised approach similar to what Cuff et al. (2008) described as decentralised "information commons" for politics, art and play. This institutional problem could be supported by appropriate digital infrastructures that need to address inequalities in access and power over places as new influences arise through the overlap of digital and virtual spaces (Kelley 2014).

2.4.4.1 From local self-organisation to transformation of institutions

Relevant to this review, recent changes to the UK planning laws introduced "neighbourhood planning", a discussion that has been generally far removed from any discussion on technical interventions. Giving communities the capacity to draft development policies on a small area basis, it has opened new opportunities for self-organisation in urban development planning (Parker et al. 2014). For example, beyond the 326 local planning authorities (LPAs) in England[42], in October 2014, 1228 neighbourhood planning groups across the UK were preparing neighbourhood plans. While this provides the legal basis for community groups[43] to engage in the development of plans for their local area, experience shows that none of these groups operate in a socio-political vacuum

---

[41] This is a scheme whereby a derelict building or estate is (temporarily) handed over to a local community group.

[42] Wikipedia (2014) - http://en.wikipedia.org/wiki/Local_planning_authority

[43] For the considerations of governance, community groups may be described as new or emergent institutions. New-institutionalism seeks to understand the values and established practices in a social activity not constrained to formal organisation. It provides a 'theory of social dynamics' concerned with why people engage in collective action; as such, the term institution does not demarcate the established organisations of politics, but rather any form of organisation around a particular issue, such as governance of a place, or organising a community group (Healey 1999).

(Parker et al. 2014). They face struggles to collaborate with and gain the support of planners. Unlike most individuals' expectations, neighbourhood plans cannot be used to prevent development, but instead need to be supportive of it. Hence, the influence of established institutions in the diverging expectations towards spatial outcomes cannot be ignored (Healey 1999).

The re-localisation of responsibilities away from a central authority (e.g. from crowdsourcing towards peer-production) shifts issues in power relations to the group itself. (Informal) community groups that attempt to self-organise their participation processes will have to face second level dilemmas with regard to establishing 'specific rights and duties' for participation, and third level dilemmas with regard to the means for monitoring adherence to these rules (Hess and Ostrom 2003). In research on governing natural resources sustainably (preventing their depletion), it was found that for functional self-governance to exist: a user group needs to be fairly well defined; rules that are developed to maintain a local resource should match the needs and local conditions of the community; those affected by the rules (supposedly the users) can participate in modifying the rules; the rights of the community to develop rules are respected by an external authority; a system should be formulated to monitor adherence to the rules; and finally it must be a system that tolerates violations of the rules and tries to resolve them through low-cost means (Hess and Ostrom 2011).

2.4.4.2 Technology-supported self-organisation

Examples of participatory geographic information systems (PGIS) and location-based services mentioned in section 2.3.5 could contribute towards an infrastructure for bottom-up participation. Supporting self-organisation by citizen groups seems to suggest that established institutions (such as local authorities) will also have a different role to play in providing technical means for participation (Saad-Sulonen 2012). This could occur by extending their expertise and capability to neighbourhood planning groups (compare (Parker et al. 2014)).

It is a long way from individual platforms, for example as provided by municipal planners, to a digital infrastructure comprised of multiple technical systems functioning alongside each other and that, together, support self-organisation within and across various social groups. From a governance perspective, Hess (1995) differentiated between control in underlying ICTs, control over datasets, and control of outcomes. A change in view from isolated, integrated systems to the interlinking of different ICTs by social practices may provide an infrastructure understanding (Monteiro et al. 2012). In the context of complex geospatial infrastructures, a "middle-out approach" is preferred in which "a federated web of loosely coupled building blocks" of data repositories emerges from the bottom-up[44] (Carrera and Ferreira 2007). Using the term 'transduction', Galloway (2004) suggested that processes and technological contexts do not change in an instant but that existing practices gradually transform until a novel form of participation can be documented.

There remain issues of provisioning geospatial technologies to communities, which continue to be dependent on the expertise delivered by academic and other non-profit bodies (Leitner et al. 2002; Talen 2000). In this socio-technical challenge of aligning digital information communication technologies to the social context of urban planning, there are still many research gaps, such as those relating to: the arrangements for data sharing and reuse such as discoverability of information holder and information seeker, methods for access to information, visual representations for making data understandable, and legal and technical support (Swarup et al. 2006).

2.4.4.3 Everyday practices

One may wonder, how the non-technicist approach, observed in self-organised neighbourhood planning groups (Parker et al. 2014), matches up with the technology-supported collaboration models. In cultural studies, focus on the everyday practices of individuals has been used as a way to "navigate objectivist and subjectivist accounts" of technology applications. It is an attempt to extrapolate the unique from the ordinary day-to-day actions of citizens. Galloway (2004) focuses on the flow of activity and events in everyday life to see how new technical artefacts are bound to social practices. She describes this as a view of transduction through which ubiquitous computing interventions become embedded in "diverse practices" (p.400). Suggesting that computer science visions of the future of interaction focus too much on the role of the technical artefact, she suggests that ubicomp technologies, where their design is informed by existing social practices, can emerge as critiques of everyday life, the mundane practices taken for granted, and the persistent networks of power that they may sustain.

In a similar vein, Crang et al. (2007) use the concept of "remediation”. Drawing on a case study of everyday practices of participants going about their daily life, such as organising a shopping trip in Newcastle, they attack the conceptual binaries between the virtual and the physical world that scholars have constructed to facilitate the discussion of the effects of digital technology in relation to spaces. Similar to Galloway (2004), they flag the importance of tracing everyday practices and interactions of various individuals to articulate how the ‘digital’ and ‘physical’ are essentially intertwined in everyday practices.

[44] A middle-out approach is considered in CHAPTER 3.

Kelley (2014) describes the use of modern geo-social software online such as FourSquare and Google Maps. Emergence of these services has made the intersection of digital and physical in public spaces real through mobile digital devices. Such services enable a digital mark-up bound geographically to various urban spaces. Pervasive technologies readily embed themselves in the perception of everyday experience of the urban space, and the citizen-generated content in them influences future choices. Thereby these services point to a profound, potentially biased, augmentation introduced by digital technologies.

The key argument of these scholars is that the focus on everyday, mundane practices is worthwhile to see information technologies embedded within social contexts. Thereby these technical artefacts and any practice related to them become essentially inseparable. The tracing of practices over time, loosens convenient distinctions between old and new practices, the virtual and the physical, and the local and the global. The call for study of the existing practices serves as a critique that could inform technological interventions that then in themselves emerge as critiques of the established, engaged practices of interaction (Galloway 2004). It is essentially that which the focus on technology-supported self-organisation suggests. It offers a vehicle to critique the engrained sets of rules and roles that represent the existing, prevalent (political) institution.

2.4.5 Section conclusion

This final part of the literature review was prompted by the call by Boonstra et al. (2011) for self-organisation of participation in planning. It sees community groups, such as in neighbourhood planning, as emerging institutions. This view fitted with the policy context in the UK (through neighbourhood planning for instance) and Healey's (2009) comment of a weak conceptualisation of place in UK's spatial planning system.

Here the review picked up on evidence from online-based collaboration to provide an indication of how such systems are deeply associated with their physical context, how there is a common struggle to associate independent inputs with collective outcomes, and the different technical and social factors that may reduce or enhance incentives for citizen participation. The example of Santa Monica's community network was used to illustrate the properties of such localised systems and earlier the review focused on geospatial platforms as a component of such infrastructures.

It was said that community groups in planning are less technologically inclined. What this requires analytically is the approach of *transduction* by which the various technical artefacts used across different groups and social settings can be seen from the standpoint of a brittle infrastructure (Monteiro et al. 2012; S. Graham and Marvin 2001). It was identified that localisation of decision authorities from a central agency (such as a local authority) to community groups will move power struggles to a different level but not reduce them. In terms of the infrastructure, important questions as to who should maintain ownership of the technological artefacts and the process of participation itself are yet unanswered.

2.5 Conclusion

The literature review suggested a gap exists between such new forms of organising and the actual technologies and techniques used by established political institutions in coordinating spatial outcomes in cities. Current planning supports software struggles to fit well with this new generation of geo-social platforms since they were not built to take-in, manage, and work with citizen-generated data.

The literature review identified online-accessible geospatial and location-based services as a domain that could enable large groups of people to aggregate and share quantitative data and updates on matters of concern with decreasing levels of effort. The resulting new forms of participation may be invoked from within a physical space and enable coordination amongst diverse sets of actors in real time in achieving common social goals. These technologies may uncover the past of places, contribute to dynamic interactions with physical space, but may also harbour risks . These risk the possibility of content manipulation and/or inequalities in access. Urban computing relies on space as a socio-cultural infrastructure (Dourish and Bell 2007) and as such it is not yet understood how and what infrastructural support could be embedded within established institutions for enhancing self-organisation by local communities.

In this regard, the review established the unresolved connectivity between the physical and the virtual, the routes to aggregating local contributions to useful collective outcomes, and aspects of incentivising voluntary contributions that have implications for institutional designs. Taking forward the contributions of Boonstra et al. (2011), Healey (2009) suggests studies of participatory practices in specific local contexts, including the workplace, organisational arrangements, and use of ICT facilities within established institutions and various individual and group actors.

For a pragmatic critique that appreciates the role of existing institutions and the renewing of the capacity of bottom-up actors, a number of questions need to be explored. In which ways has the physical space been appreciated in existing forms of participation in planning? What are some of the key institutional and technical dilemmas apparent in these existing forms of participation? What new alternative forms of institutional and technical considerations are apparent in new forms of participation?

TRANSITION

More than the literature review in the preceding chapter, the following position paper made the case that the increasing infusion of various urban processes with digital computational devices and techniques leads to the emergence of ubiquitous computing infrastructures. Some may argue that this has occurred already. Going beyond the literature review, it places a firm focus on the role of spatiality in governing digital infrastructures and the data they serve. Based on a comprehensive review of recent technological trends, this position paper develops illustrates the fragmented nature of digital ICTs in cities and develops the concept of "community data" based on the premise that citizens of the collected data should be involved in its governance. In it democratisation of digital infrastructures was understood as "the acceptance and the assumption that personal data collected through ubiquitous devices needs to be put in control of the person and communities originating it, which requires conscious reflection where top-down sensing can be achieved by local control instead". The position paper was presented at the Ubiquitous Computing 2012 conference in Pittsburgh.

The argument set forth in the paper raises a number of critical questions towards the way we govern the vast volume of data from and about individuals and things coming from both situated and mobile sensors on the internet. I encourage my readers to review this paper with an appreciation of its obvious flaws. The paper presents a wide-focused response to the many ongoing changes to everyday life in public spaces induced to digital infrastructures and how the 'everyday' and the non-experts may play a greater role in digital infrastructures in the future. It employed strong terms, such as that of 'control'. De Lange and de Waal (2013) injected that a concept of non-expert 'ownership' over technological capabilities may be a better term to incentivise open participation in what technological capabilities a city should provide and in how far citizens have a say on these said capabilities. In many ways the paper is a prototypical position statement that will warrant further empirical work of cases of information management by various community groups in the city.

At the time of writing this thesis, the paper had received 14 citations since its publication in 2012. These citations contain a diverse set of writings, including reviews of the emerging field of urban computing, ethnographic studies of informal actors 'infrastructuring' information technology suited to their purposes, studies documenting the development and testing of systems with which non-experts can analyse their own data shadows, and conceptual papers discussing the emergence of 'the quantified neighbourhood'. In the forthcoming years, as public urban spaces are becoming ever more augmented by various digitally-enabled Internet-connected devices, I am hopeful that the arguments set forth here will attract further attention.

CHAPTER 3

DEMOCRATISING UBIQUITOUS COMPUTING – A RIGHT FOR LOCALITY

3.1 Abstract

Trends such as the increasing adoption of smartphones, the development of the service-oriented Internet, and diffusion of sensing technologies into cities have the potential to combine to form a ubiquitous computing infrastructure. At the same time, as the computer diffuses into the physical world, it loses its location-neutrality, exposing the urgent need for a debate of design choices in ubiquitous computing. In this paper, we discuss the process of urban development as a source of inspiration for such design choices. Looking from the ground up, of particular interest is the opportunity to localize and democratize an emerging ubiquitous computing infrastructure. The design choices we negotiate today will determine the society in which we will live in the future.

Authors: Sebastian Weise, Paul Coulton, Pragya Agarwal, John Hardy, Adrian Friday, Mike Chiasson

Author Keywords: ubiquitous computing, urban process, democratization, data rights

General Terms: theory, design, human factors

3.2 Introduction

In a world in which many physical objects gain the ability to generate data about their environment, we are faced with questions about how to ensure that the value of this data is shared for the common good rather than kept for the corporate interest of a few global companies. While a great strength of information communication technologies (ICT) has been to break down the barriers of geography, as digital devices diffuse into the physical world, such as with ubiquitous computing (ubicomp), their relationship with the physical locations in people's lives strengthens. In advanced cities, the emergence of a 'ubiquitous computing infrastructure' as a general purpose utility moves closer through new paradigms such as 'urban computing' (Zheng et al. 2011). Recently, scholars envisaged further combining previously disconnected data sources (Zhang 2011). This alludes to a shift in society's behaviour on a large scale, wherein the ownership and management of 'ubiquitous data' as well as the underlying infrastructure is far from clear (Cáceres and Friday 2012). This raises fundamental questions about who designs, controls and uses the data generated from individuals' activities.

Cities are places which feature a high density in technological infrastructure and social activity and thus function as today's testing grounds for novel ubiquitous computing technologies (e.g. Anon n.d.). In this article we seek to explore democratic issues and choices in the design, control and use of ubicomp systems through a discussion of the process of urban development, which we consider to be a societal process focused on effecting urban change.

This paper is structured in four main parts. After an introduction into the issues involved in scaling ubicomp technology to a societal level, we describe core essentials of the urban development process. We then explore the current state of selected existing ubicomp systems relevant to today's urban environments with a focus on delivering a next-generation infrastructure and propose a framework informed by the urban process. Finally, we discuss a possible future in which ubiquitous computing enhances the social process of urban development.

The role of ubicomp as infrastructure in these activities is becoming increasingly important and has the potential to exhibit many potential negative and positive effects[45]. The extent to which these effects are manageable, and indeed felt, will depend greatly on the design choices which control the use of the data that people generate. We believe it is important and timely to open a discussion around this topic to help develop a society which is able to design, control and use ubicomp infrastructure and the data it generates to help meet society's needs. In doing so, we hope to avoid fear of a dystopian surveillance society and instead work towards a world in which ubicomp data serves the collective good.

3.3 Evolving visions of ubicomp

A key part of Weiser's original vision was the concept of an interoperable, ubiquitous ICT infrastructure with many unobtrusive interfaces to the physical world materialized through simple devices embedded in the world, supporting natural interaction with their users (Weiser 1991). As we now know, his vision catalysed a broad research field, which encompassed investigations into new forms of sensing, smart artefacts, context-awareness, and many other areas (Rogers 2006). Ferscha (2012) summarizes the emphasis throughout the years as being on 'connectedness' (late 1990s – 2000), 'awareness' (early to mid-2000s), and 'smartness' (mid-2000s to present).

[45] Partly this issue is addressed in the field of urban computing, that overlaps with ubicomp. For a definition and distinction see Foth et al. (2011)

Increasingly, the direction of the research community has been critiqued. For example, Bell et al. (2007) noted a tendency to focus on a never-quite-achieved immediate future, which translated into a lack of regard for already adopted ubiquitous computing technologies. For Rogers (2006), ubicomp research has lacked an understanding of people as ‘proactive actors’, who should be supported in the social activities they already do, rather than continued demonstrators and proof-of-concepts with what Sharp et al (2005) identified as a ‘technology-led’ focus divorced from real-world problems.

As a result, while many prototype systems exist, twenty years after Weiser’s original vision, challenges remain not only in the scaling and use of ubicomp technology and its integration beyond the home or office (Abowd and Mynatt 2000), but also in its social acceptance and general availability in the public realm (Cáceres and Friday 2012). Below are three such aspects to these unresolved issues:

- Concerns about the ethics of the social impact, particularly relating to user data privacy and security (Cáceres and Friday 2012; M. Conti et al. 2012; Kumar and G. Conti 2012; Rogers 2006) through the ability to collect behavioural, personal and biological data (Wright et al. 2008).

- Lack of examples of feasible business models for the large-scale application of ubicomp technology (Cáceres and Friday 2012). This is further exacerbated by the lack of long-term studies of existing use cases (Sharp and Rehman 2005) and the absence of large-scale well-defined scenarios.

- Lack of standards (Cáceres and Friday 2012) as well as continuing technological challenges in context and activity recognition (Leahu et al. 2008).

Addressing these challenges, Abowd et al. (2000) highlight how individual ubicomp systems need to ‘create compelling stories’, which can provide implementation goals, perceived benefits, and success criteria for the technology. Additionally, McCullough (2004) specifically calls for a “focus on habits rather than novelties, on people rather than machines, and on the richness of existing places rather than inventions from thin air”.

We agree in principle with both statements recognizing that the diffusion of ubiquitous technologies into society is an inherently complex and uncontrollable process. Indeed, this is especially true once we move beyond individual ubicomp applications (e.g. an ICT-supported car rental scheme) towards what we might call a *ubicomp infrastructure*, meaning the collective of connected ubicomp systems (e.g. a car could be rented through a mobile device and its mobility could be tracked for traffic monitoring).

Such an infrastructure stretches the capabilities and possibilities for data collection and use, and moves ubicomp towards the centre stage of society as mentioned by Zhang et al. (2011) through a combination of developments: These include changes to the Internet to be more content-centric and 'social', the widespread adoption of powerful portable devices in particular smartphones, and the diffusion of stationary infrastructure sensor technologies into the urban environment. Due to this increasing emergence of data flows, it is even more important to consider the design choices that promote or inhibit democratic participation in the design, control, and use of ubicomp systems and data.

We now discuss the urban process with its main issues (including scaling, local change and negotiation between different stakeholders) to explore design choices for a ubicomp infrastructure and the data generated from it. Here we use *urban process* to mean the process of urban change without explicitly assuming agency of particular people in the process. Later we specifically reflect on the *urban development process,* which includes planning within an urban context, including both a participatory, user-led approach, as well as the institutional process of planning within a prescribed set of guidelines.

3.4 The urban process

In this paper, we view the making of the city as a complex process made up of flows of financial capital, physical resources, people, and now increasingly information and ideas (Kesselring and Canzler 2008; Castells 2000; Williams et al. 2009). The flows are entangled in the power dynamics of people controlling and augmenting them, which in turn affect the construction of the city. This leads Massey (1993) to describe places as "articulated moments in networks of social relations" without clear boundaries, continuously influenced by networks which reach beyond a particular place.

3.4.1 Scales implicit to the urban process

The urban process is a scaling problem in which mutually dependent parallel processes play out across multiple different spatial and temporal scales. Wegener et al. (1986) differentiate between long-term change processes related to the physical built environment with lasting effects of up to 100 years, medium-term changes related to socio-economical activities undertaken in the city which may manifest within 20 years, and short-term changes such as the daily mobility patterns which may change dynamically from day to day.

An observer may often find it difficult to perceive the slow changes to the city. For instance, the built infrastructure is far more durable because of social rules in the form of land ownership and thus Wegener et al. indicate that it changes only 2% each year compared to information in digital form, which may have a much shorter use value.

Independent, relatively minor, adaptions to the urban environment can be considered 'indirect design' (Carmona et al. 2010). An example of these independent adaptations is the number of planning applications, which represent individual investment decisions in the context of a legal framework. This compares to larger-scale infrastructure investments such as the development of a new railway line, which demand the mobilization of considerably larger number of factors and involvement of more actors and thus takes place on a much longer temporal and larger spatial scale.

Urbanization is strongly linked to proximity and the sharing of resources, which helped people live more efficiently together for trading and protection. While ICT has weakened the first law of geography (objects in proximity are likely to show more similarities (Miller 2004), studies continue to show the importance of proximity in the social life of individuals (Gonzalez et al. 2008; Ratti et al. 2007). While change in the city can be broken down into various levels of spatial abstraction starting with a specific location, pinpointed through a relatively precise geo-code to citywide scales defined by institutional boundaries, citizens socially construct an understanding of places and neighbourhoods in their city as well as its spatial scales (Dourish 2006). Additionally, communities inhabiting the city may develop multiple understandings of particular places and territories. Williams et al. (2009) mention that most ICT systems in this context tend to overemphasise design for the affluent and mobile 'flaneur' while disregarding other minorities such as immigrants and the homeless, which also contribute to the feeling of a place.

3.4.2 Infrastructures and the urban process

For a large part, urban development has been concerned with a replication of infrastructures, defined by the Oxford English Dictionary as "the basic physical and organizational structures and facilities needed for the operation of a society…", which enable the flows mentioned previously (i.e. finance, goods, people, information) across different spatial and temporal scales. From the discussion of infrastructures, we highlight two main points.

3.4.2.1 The enabling power of infrastructures

Infrastructures are prerequisite for cities to function, they provide the 'habitat', which helps or hinders particular social activities. In recent years, the availability of large-scale data capture and analysis has contributed to our understanding of how urban populations and their infrastructures relate.

In a landmark quantitative study, Bettencourt et al. (2007) used a wide range of statistical data (such as electricity consumption, length of road networks, employment figures, and number of registered patents) for a sample of US, Chinese, and European cities. They arrived at a universal scaling 'law' in which economies of scale in physical infrastructure are in tension with economies of scale in social properties: As a city doubles its population, infrastructures would scale sub-linearly, indicating higher usage efficiency. At the same time, those from social interactions (such as crime and innovation capability) scale super-linearly by a factor of approximately 15%. These results imply that, theoretically, there is no limit to a city's growth as long as innovative capability through social interaction produces increases in efficiency in the underlying city infrastructure at an increasing speed.

A potential benefit of ICT in this case is that it can become a driver for increased efficiency for cities. Cuff et al. (2008) have mentioned the potential of ubiquitous computing application in urban development and it was noted that mobile phones, for instance, have the potential to enhance interactions within a city through immediate feedback loops. These and other similar technologies enable the augmentation of ongoing processes and decision-making based on near to real-time information (Townsend 2000).

3.4.2.2 The social origins of technical infrastructures

The manner in which these infrastructures are designed, managed and used is reflected in the organization of society. This is due to the social powers within which these infrastructures are embedded (Massey 1993). Electrification, for example, as the last infrastructural paradigm shift, saw the shift from local production of electric energy by consumers (i.e. steam and water turbines) to centralized, but more efficient energy generators managed by large utility companies, which subsequently gained more bargaining power (Nye 1992). Carr et al. (2005) argue that a similar process is emerging for computing resources, citing the example of the adoption of cloud services on the Internet: In electricity networks the application of the electric energy would still be enacted locally through an 'electronic endpoint', i.e. a physical device. Digital infrastructures however take the additional step of remotely running the application, which means that service providers can manage the application of computing resources and the output in terms of data at the same time.

A ubiquitous computing infrastructure can play an important role in enabling and enhancing beneficial social processes as, unlike electricity, digital infrastructure enhances a society's cognitive power by its ability to connect people and information[46] (Mitchell 2000). While infrastructure projects in the past had the idealistic notion to connect the urban realm and its communities of different ethnicity, wealth, and beliefs, Graham and Marvin (2001) note the increasing fragmentation of the management and ownership of infrastructures. They make the point that an "infrastructural individualism threatens to emerge" in which disadvantaged groups could be further marginalized. In this way, a ubicomp infrastructure could also have the potential drawback of excluding those not in direct control.

3.4.3 Urban development as social process supported by ubicomp infrastructure

In the discussion of democratization of ubicomp infrastructure, one that does not serve as a means for excluding particular publics and with the intent to achieve an open society, we attempt to uncover the fragmented ICT landscape in cities through a contextualization of their power dynamics. To further the discussion, we propose a conceptualization of the urban development process and the key stakeholder groups involved (Figure 5). This provides a way to reflect on the design choice possibilities for community management in an emerging ubicomp infrastructure. This framework contains implicit notions of spatiality, whereby local individuals, their representative public authorities and 3rd parties (i.e. businesses and other special interest groups) are, through a simplified view, considered in the context of their use of ubicomp data. While public authority is localized to support a particular community, businesses may provide services on a global scale.

---

[46] Mitchell (2000) does not refer to individuals' cognitive abilities being as such but rather ICTs, through their ability to serve for better coordination and information retrieval, enables creativity and problem-solving amongst large groups of individuals.

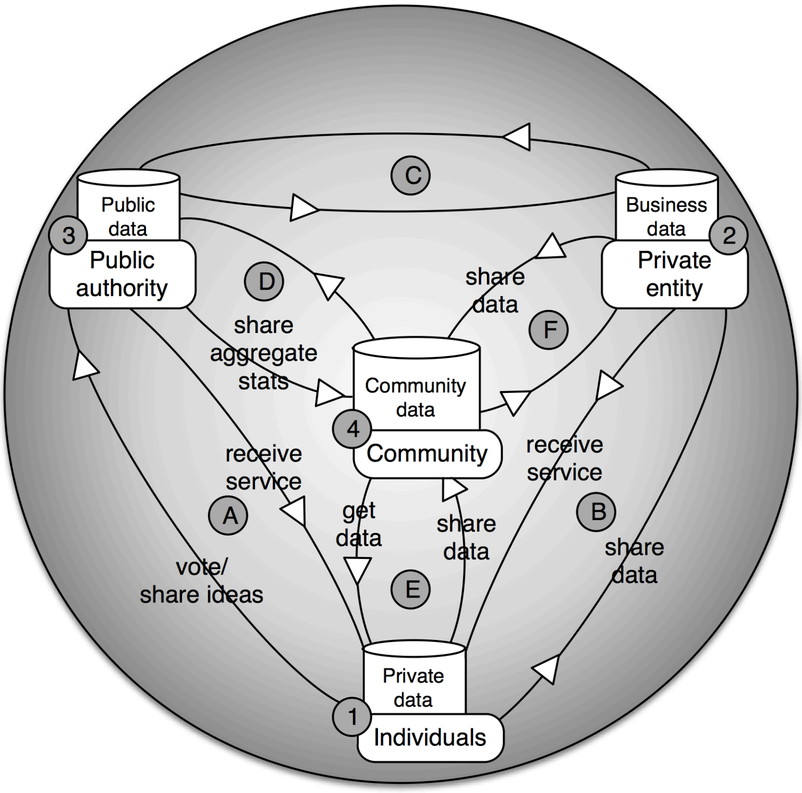


Figure 5: A value network for ubicomp data

Each of these stakeholder groups maintains some private repository of data generated through different means, for example:

- **Individuals** (1 in Figure 5) 'own' demographic data, produce user-generated content through online interactions, and additional contextual data (such as mobility or payment data) through interactions with ubicomp devices.

- **Private businesses** (2 in Figure 5) aggregate information such as customer statistics and other non-public operation-relevant data. They also generate some public content in the form of adverts or general information.

- **Public authorities** (3 in Figure 5) maintain large repositories of statistical data collected from citizens or businesses and others beyond (Mayo and T. Steinberg 2007). Data includes planning applications, tax payments, and social care statistics.

- **Community data repositories** (4 in Figure 5) are emerging aggregators for local ubicomp data coming from the above three stakeholders.

Conceptually, the urban development process involves data and information collection as well as exchange between the different stakeholders for achieving social value. Use case examples for data exchanges may be official voting (A), social media services (B), and taxation (C). While data is shared amongst each group with various levels of privacy, some is specifically used in public discourse such as the urban process. We considered such data as 'community data' (4 in Figure 5), used here to imply the data generated in a ubiquitous computing infrastructure through interaction with ubiquitous devices with relevance to the area in proximity to these devices. Existing use case examples of community-relevant data collection include open data stores or civic dashboards established by cities such Birmingham (Birmingham City Council 2012) (D), participatory sensing initiatives (E), and traffic monitoring through mobile phone networks (F).

We argue that it is this process which ubicomp aims to support at a societal level. The various choices for the democratic influence of people on the collection and use of data, and the design choices for the ubicomp infrastructure are in front of us now. The choices made today will have a dramatic effect if and how this infrastructure will serve (or not serve) the citizens.

In the next section, we explore the current form of this emerging ubicomp infrastructure. Appreciating the criticism by Bell et al. (2007) we review examples of ubiquitous computing systems operating in urban environments today with respect to their potential to generate community data.

3.5 Fragments of a ubicomp infrastructure

In exploring how the bundle of ubiquitous computing systems develop into an infrastructure, it is essential to understand not only the types of digital technology in urban environments today, but also the design, control, and usage scenarios that are typically used in their implementation. In doing so, we will need to go beyond the traditional focus of ubicomp technologies and also include projects related to mobile computing as well as the open-data movement, which originated from the opening up of public data repositories by public authorities.

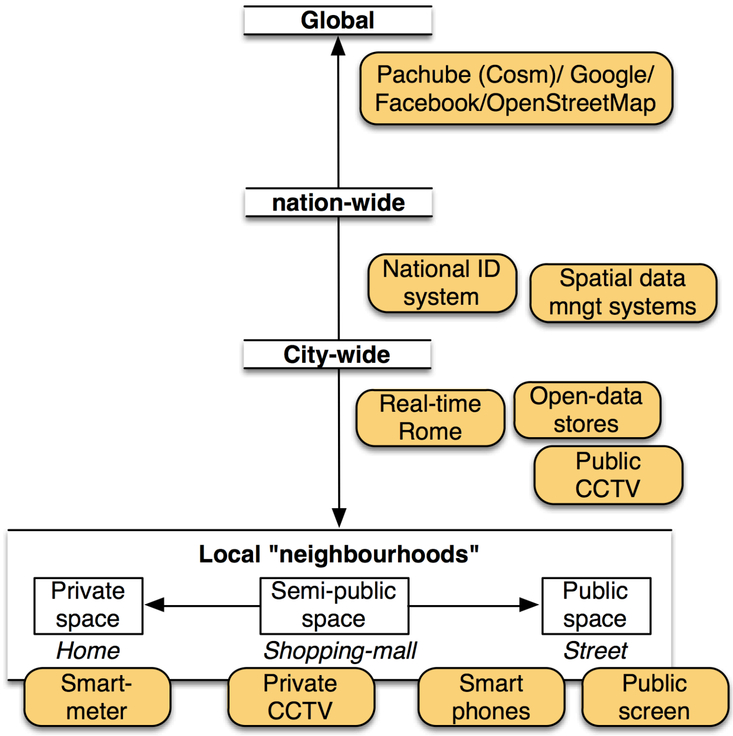


Figure 6: Mapping of current ubiquitous technology

Temporal and spatial scales are important not only to the urban development process, but as Carceres et al. (2012) note, also represent challenges for data management in a ubiquitous computing infrastructure. We aim to consider the scale of application of the particular technology as well as the use of the technology by mapping a number of existing digital networks listed in this section onto the geographical scale in which they are located and the accessibility of the data in the particular system (see Figure 6). This overview is by no means exhaustive but should help to understand the diffusion of digital technology into the urban process today. We see the following developments:

3.5.1 Top-down sensing applications

In cities, a number of large-scale urban monitoring projects rely on mobile phone networks. Researchers at MIT's Senseable Cities lab for example were among the first to use mobile phone data to understand urban mobility. Example projects include 'Graz in Real-Time' (Ratti et al. 2007), Real-time Rome (Calabrese et al. 2010), and Live Singapore (Anon n.d.). Initial projects provided proof-of-concept systems with a focus on the arts. Projects are largely based on anonymized real-time data from large communication infrastructure providers (case F in Figure 5), where mobile phone users provide no formal opt-in. Potential emerging applications include traffic and bus route planning, but also individualized applications such as detection of mobility preferences and capturing of personal environmental impact (Brush 2010) (case B in Figure 5).

Other examples that facilitate city-wide mobility infrastructures include the sensing of urban traffic in which taxis are used as mobile sensors to inform failures in urban planning (Zheng et al. 2011), or the identification of urban dynamics through data collected from a bike sharing scheme (Froehlich et al. 2008). Additionally, these providers are often city-specific. In comparison to mobile phone network data, the advantage here is that shared infrastructure is used to understand city dynamics without the need for monitoring individual traces.

3.5.2 Participatory sensing

Another stream of work includes participatory sensing applications (Burke et al. 2006), in which citizens deliberately and knowingly upload data they sense through devices, such as mobile phones (case E in Figure 5). This emergence of mapping techniques, or participatory GIS, for local communities, can empower grassroots organizations and disadvantaged groups by providing shared narratives and a sense of awareness through the data to support their cause (Sieber 2006). Increasingly, geo-referenced content is submitted directly from mobile phone platforms, which use the camera and microphone of the device. Researchers point out that soon phones could also include sensors for capturing other characteristics of the environment, such as temperature and humidity (Cuff et al. 2008). Systems are often limited to a single purpose (Muller et al. 2011), such as noise sensing (Kanjo 2010; Maisonneuve et al. 2010). Another recent area of success is represented in the OpenStreetMap project, a large crowd-sourced and open-source mapping data repository based on input from 33,000 'social sensors', which generated a free-to-use, open-source competitor to dominant commercial mapping providers (Haklay 2008).

3.5.3 Infrastructure sensing

Other companies focus on the development of platforms for the sharing of data from stationary physical sensors from other ubiquitous systems such as sensors in buildings. Infrastructure providers have conducted much research into sensing the street traffic and electronic consumption. Companies such as Pachube/Cosm (Cosm n.d.), which connect sensing devices, aim to provide platforms for an 'Internet of Things' (case B in Figure 5).

The urban environment today includes many situated devices already used as sensors, such as CCTV systems, but the examples mentioned above previously (e.g. a collection of bike racks used to sense urban mobility), suggest that there are many other opportunities for information sources and devices one could use. Traditionally, these have not received much attention from the research community, such as parking meters, ticket machines and ATMs.

3.5.4 Public displays

Public display systems point towards future interface technologies in a ubiquitous computing infrastructure. Typically these are situated in the public domain and have been used to provide public access to community data. Nevertheless, interactive public display systems that take advantage of such data streams remain rare. Recent examples include the UBI hotspot system in Oulu, which distributed interactive screens throughout a town centre (Ojala et al. 2010). These afford individualized interaction directly through touch, or indirectly through mobile phones to share photos, videos, or short text messages. Here they have faced some of the intricate data management challenges that arise when individual user input, local community information, and 3rd. party commercial information interact and become visible. In a similar manner to the UBI-hotspot system, a campus-based display network is used at Lancaster University to disseminate community-relevant information (Storz et al. 2006).

3.5.5 Open and hyper-local data

A related important development driven in particular by governments today is the recognition of publicly available data sources. In several cities, open data initiatives have resulted in the establishment of hyper-local data stores, i.e. locally collected data available globally (case D in Figure 5). New types of content management systems are emerging, which are specifically tailored for the distribution and management of data feeds, such as the open-source project CKAN (CKAN n.d.), which powers the datastore of the Greater London authority. Apart from the local storage and management of the data, new ways of engaging with local data are needed to provide connections between local data capture and actions that results from it. The representation of community data is largely nascent and we know only of examples where the representation is aimed at informing and less at encouraging action. Example projects include the recent implementation of dashboards to visualize statistics of citizen requests made to a city council (Birmingham City Council 2012) and the visualization of local communication in a business cluster based on Twitter data (Anon n.d.). In the context of urban planning, as introduced in Figure 1, these initiatives could present community data repositories on different spatial scales, in which data flows combine together to support local decision-making.

At the same time, we can identify a trend of large web companies to capture much more personal data on their users than ever before. More data of citizens relevant to the public discourse is shifting into the realm of social media. Here large global companies set out how collected data is used, managed, and stored, although data use may be for public purposes and local interest. Cases include search companies, which recently embarked on a restructuring of data management policies to profile users for better advertising by fusing data items such as mobility, website browsing behaviour, and social network information (Kanter 2012) (case B in Figure 5).

3.5.6 Discussion

In the context of urban development, the knowledge and creativity of citizens is leveraged to contribute to the development in their local area (Brabham 2009), and as such it is important to appreciate the contributions individuals make through their interactions to their local environment. Studies show that individuals are largely habitual in their mobility and likely to return to only a few locations frequently (Gonzalez et al. 2008). Evidence suggests that they are more likely to participate in decision-making on matters of concern in their own proximity (Alt et al. 2010). That indicates that as digital devices diffuse into neighbourhoods, there is a case for public ownership and control of data relevant to an urban community. Further, this strongly suggests that location is an implicit aspect to the management structures within any future ubicomp infrastructure.

A key question will be how the various examples of ubicomp systems cover and avoid particular approaches to citizen-led influence over a ubicomp infrastructure. Brabham (2009) notes, that the urban development process is a public process of participation between various stakeholders, some of which have formal roles (e.g. urban planners, business owner). In a future ubicomp infrastructure based on the notion of 'community data' citizens may perform informal functions by interaction and management with the infrastructure and its data.

Given that individuals today are creators of digital content on the Internet, ubiquitous computing should enable their active contribution to urban development through decision making acting on data generated locally. Such contributions are increasingly made though crowdsourcing applications as a general-purpose problem solving technique enabled through ICT, in which a large group of citizens would explicitly collaborate to build "a long-lasting artefact that is beneficial to the whole community" (Doan et al. 2011). Examples such as Wikipedia have shown that motivations to participate in crowdsourcing models are manifold and do not necessarily require financial incentives. Here new social functions may need to be negotiated for working with community data. We outline this with a schematic flow of how stakeholders augment their local environment (Figure 7 and Table 3) with a focus on data collected and how it supports the urban development process as described previously. Inspired by research on social roles in online crowdsourcing systems (Gleave et al. 2009), as a starting point, we propose that the following roles may emerge in 'community data' management. The list is not exhaustive and any one stakeholder may, at different stages, perform different functions in the process. Subsequent work is needed to enumerate and understand them all.

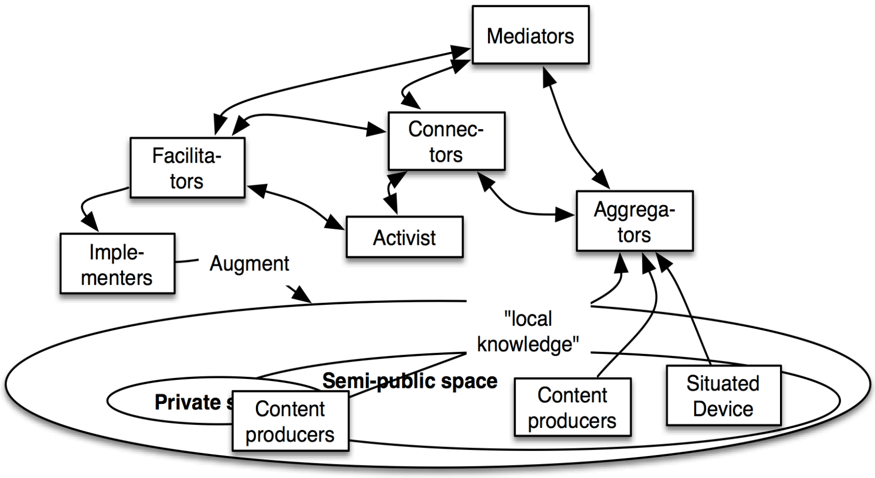


Figure 7: Schematic view of potential stakeholder' roles in ubicomp data management

Function	Potential actors
Content producers (inc. situated devices)	Individuals through personal and interaction data; automated sensors monitoring environmental data (such as traffic)
Aggregators	Community organizations such as business improvement districts and neighborhood watch programs
Connector / Curators	Actors who merge and curate data from different aggregators to derive a trusted 'community data set' from business, individual, and government data
Mediators	'Information brokers' who disambiguate different sources of information
Facilitators	Individual activists using data to drive change
Implementers	Actors affecting change in the urban environment based on plans developed by use of ubicomp data

Table 3: Potential user functions in ubicomp data management

In such a location-sensitive infrastructure, there exists several ambiguities with regard to data communication:

- **Localization of data and its management**: for data we need to ask where would ubiquitous computing infrastructure house gathered data, how origin, attribution, and traversal is logged and whether it would be possible (or worthwhile) to forget it (Cáceres and Friday 2012)?

- **Access**: Ambiguities exist with respect to the local specificity of computing services and the accessibility of data from outside of the context. Should we be able to access a public CCTV system 2000 km away or should there be local restrictions in place that prevent such a scenario from happening?

- **Place and networks**: Related design choices include the level of automation, the locus of control[47], and duration of settings (McCullough 2005). Will we face different ubiquitous networks at a particular public location or will we interface with a unified service layer, which centralizes the various options that a ubiquitous computing infrastructure affords (Poslad 2009)?

In the next section we will focus on the first two design choices, which address the concerns about ubicomp infrastructure's social impact as noted in the introduction. We do so by reflecting on the lessons we can take away from studying the urban development process to develop positions on the two principles of individuals' rights to data contribution and community data control for deriving a possible future scenario for ubiquitous computing infrastructure.

3.6 Democratisation and control

Democracy in the urban development process implies that individuals have both an equal stake as well as a right to participate in the shaping of the local environment. As digital devices diffuse into the physical world, we argue that the impact of data is often strongest when reapplied in the context of the source that generated it. Therefore we believe that a future ubicomp infrastructure needs to feature a sensibility for local control.

Furthermore, data management in a ubiquitous computing infrastructure should avoid an imbalance of data flows (such as to stakeholders 2 and 3 in Figure 5), which are of relevance to a local community. In this case we can see the need for local control of the community-relevant infrastructure. In a future ubiquitous computing infrastructure, it would be incorrect to assume that technology could be only owned by the people, but while specialized infrastructure providers could compete for and contribute to the deployment and running of the hardware and related software interfaces, the key democratic aspect comes from the transparency of data management[48], in which each individual maintains a right to decide individually whether and what data to contribute depending on the situation and service or perceived benefit received in exchange.

[47] In the discussion on who controls technical interventions in the urban space, de Lange et al. (2013) instead discuss the concept of ownership, the perception of having the right to participate.

[48] As the external examiner correctly remarked, unfortunately this is extremely challenging to achieve at the level of computational logic given present-day software architectures.

3.6.1 Identification of individuals

In a ubicomp infrastructure the ability to identify an individual is a major issue users are concerned about (Zhu et al. 2011). Research shows that despite localization service providers having privacy policies in place, data is often collected from which the individual can often be identified regardless of the anonymisation applied (Brush 2010), probably due to the relative regularity in people's mobility patterns (Gonzalez et al. 2008).

The Internet for a long time offered anonymity through the ability to use pseudonyms and to provide identity components, that were not necessarily checked by service providers. While a discussion of identity management in ubiquitous computing has yet to reach a consensus, private business platforms already function as 'passport issuers' for Internet services through their authorization portals. This development appears to imply a shift of data to private business (shifting to the right hand side of our model in Figure 5). Alternatively, in the online sphere, nascent services, such as Mydex (Mydex n.d.), which intend to provide personal data stores, may offer interesting choices for how to connect personal ubiquitous devices to such a data store with self-set sharing guidelines for personal data to which the ubicomp infrastructure needs to adhere.

Furthermore, based on the discussion of the urban process, different uses of data shared by the individual emerge (as indicated in Figure 5). The individual can share data with private business in exchange for a service, where the aggregate of usage statistics may be useful for a local community (such as in the case of taxicab traffic monitoring (Zheng et al. 2011)). In another case, the individual may choose to share data with a public authority, for instance, in the case of a public vote for which authentication of the user may be necessary to provide legitimacy. Eventually the individual may decide to contribute data from ubiquitous systems to a community purpose such as in the case of participatory sensing or local neighbourhood watch program.

Indeed, in the context of the public places where we are still rather used anonymity of our digital identities, it will occasionally be desirable and perhaps critical to be identifiable if contributing data to the local sphere[49]. In the case of urban planning it may be desirable to establish whether a user in a localized ubiquitous computing infrastructure is a local resident and thus entitled to participate in voting initiatives. The VoiceYourView project provides an example how ordinary visitors in a place can contribute to urban change through commenting on their environment (Whittle et al. 2010). Participatory

[49] For example, neighbourhood planning in the UK, in order proceed, requires a positive outcome in a referendum that involves local residents.

initiatives such as the OpenStreetMap project for example decided to make their users identifiable to add a level of traceability, which is used as a tool to discourage copyright infringement (Haklay 2008).

3.6.2 Community Rights Management – Right to locality

Appreciating the potential for complexity to emerge bottom-up through rich interaction, we advocate the ubicomp community to focus on infrastructural efforts supporting local communities in control of data (as mentioned in the preceding section). Given the increasing decentralization in decision-making made possible by the Internet (Brabham 2009), which enables individuals and groups alike to organize themselves, we think that location-based control of data distribution should be given greater control in a ubicomp infrastructure.

Whilst it could be argued that the individual owns the data they generate, moving and living in the urban environment makes them part of one or more communities. Generated data may be of value to the community inhabiting that environment. While the data is potentially also of value to parties beyond the locality in which it was collected, as the data relates to those who occupy that space, we argue that they should be given the opportunity to decide which data and the level of its granularity is made available. Community-driven management realms could be established through forming of partnerships on the local level. Examples for such partnerships could be neighbourhood watch programs for residential areas or business improvement districts for town centres in which co-located participants make decisions for the local area.

To support public processes by involving citizens, we argue for the need to implement a community rights management system for ubiquitous computing data, which is underpinned by the appreciation of localization in ubicomp data management. For such scenarios, data from the public ubiquitous devices generated within a local area does not need to be hosted by location-neutral global companies, but may arguably be better managed by the local stakeholders involved. We argue that the infrastructure for community repositories enabled through associated ubiquitous computing devices (e.g. localized sensing infrastructure) needs to be managed by the local residents similar to cooperatives to provide accountability. Data collection through user involvement would retain the management and ownership in local hands.

Nascent open-data storage clouds (such as CKAN) may provide inspiration for how local ubiquitous devices could feed into a data store for community-data. Gerhard Fischer's methodology of meta-design (G. Fischer et al. 2004) could provide pointers for the development of such systems in the respective context. Meta-design methodology seeks to involve users not only in the design process of a system but also as continuous shapers of an initial evolvable implementation: Meta-design comes in three stages as designing for design (i.e. drafting of a system), designing together, which is a learning aspect, and designing 'the in-between'. The approach is supported through a seeding model, in which the initial system should be 'under designed' for resolvability, which after a time of use is used to 're-seed' the system in an adapted way (G. Fischer et al. 2004).

Community rights management would be based on individual privacy rights settings in various public and semi-public places to articulate to users which data would be shared for location-sensitive community development purposes. Similar to the thinking in literature on crowdsourcing, ubiquitous computing infrastructure would provide a generally accessible portal to such community data. This part of the system would not be based on advertising or other commercially focused model to finance the data management but instead rather be financed through public money or directly by the users involved.

Places need to indicate the presence of particular sensing technologies and provide clear data handling policies as citizens navigate the complex amalgamation of public and private digital 'realms' in the city. Privacy certification services similar to fair trade labelling for food would guarantee compliance and increase trust. Langheinrich (2002) provides an early privacy control system which relies on user-set privacy policies on a 'privacy assistant', which negotiates data sharing with corresponding 'privacy proxies' for each ubiquitous device close by. It is arguably important for particular places to implement standards-based interfaces according to particular locations in a service-orientated manner where different stakeholder groups (community-managed localities, public authority requests, and 3rd party services) announce their data needs to the user simultaneously based on preferences set in a personal data store that governs which data to share, where those preferences could evolve with an individual's mobility pattern.

A challenging case in community rights management exists in the presence of perceived threats: Sakaki et al. (2010) present a system that facilitates the analysis of Twitter messages for emergency response in Japan. This implies that there may be cases for management and accessibility of data on a larger geographic scale — a case for which the benefits need to be carefully considered in the general case if it means a loss of local autonomy and a possible power shift towards other stakeholders external to the local community.

3.7 Conclusion

The future of ubiquitous computing as an infrastructure is being shaped today in our neighbourhood and its principles of design have the potential to transform society. It is the way in which ubiquitous computing technologies are managed, combine, and exchange data, which will influence whether our society will mainly be led in a top-down manner by businesses with private interest, which occasionally clash with the interest of local communities, or whether ubiquitous computing technologies succeed to position themselves in society in a manner, that empowers individuals as the central part of the system with full ability to make own choices[50].

We strongly recommend that as new ubiquitous computing concepts such as social and urban computing are being proposed, which aim the integration of data from sources as diverse as web data, environmental sensors, and mobile phone devices, it is important to take a step back and consider the effect of such data syndication and the array of special use-cases, in which different combinations of data syndication may make sense. The urban process was highlighted to facilitate the discussion on how the balance between the collective of individuals (society), functions of administration (public authority) and commercial interest (such as businesses) could be used to help towards making crucial design choices.

We point out that for the level of transparency of the infrastructure, in the future it is important to consider the usage of data items shared. Democratization of ubiquitous computing starts with the acceptance and the assumption that personal data collected through ubiquitous devices needs to be put in control of the person and communities originating it, which requires conscious reflection where top-down sensing can be achieved by local control instead. As individuals away from home leave more traces behind while interacting in public environments, we need to think about ways to show to residents what data is collected and for which purpose by indicating it at the particular location to differentiate between those parts of the data traces that are to be used for commercial interest and community data, which are data repositories needing to be managed not by an individual, but rather by the collective of the people for example in this particular area.

We call for research in ubiquitous computing which seeks to understand how non-experts could collectively administer ubiquitous computing infrastructure and the data that originates from localized devices. We highlighted meta-design as a potential framework on which ICT tools for community empowerment could be built. Furthermore, initiatives in the field of participatory sensing and open data provide pointers for such a research agenda. This brings people back into control of their personal ‘data shadow’. While individual data privacy is in dynamic interplay with the digital society, making the

[50] In hindsight, as articulated in the transition statements, this statement serves a binary purpose which is an overly simplified abstraction of the complexity and messiness of urban data ownership

infrastructure accountable through local control can garner support, open up interesting design choice inspirations, and enable society to reap the benefits from this next-generation infrastructure.

3.7.1 Acknowledgements

Thanks go to Monica Büscher, Drew Hemment, Bethan Owen, Maria Terzi, and Stephen Wattam for helpful comments. This work is partly funded by the Digital Economy program (RCUK Grant EP/G037582/1) of the UK.

Transition

The previous two chapters were indicative of the complex interdisciplinary field and the multiple concerns that occur within urban computing. The literature review pointed to the potentials of collaboration and collective action, while the position paper took a critical stance and pointed to the need to be careful in integrating multiple diverse public-facing ICT systems. In a city context this might lead to McCullough's mirror worlds, crowding out what he considered the important and real textures of non-digitally augmented objects and facades in the city (McCullough 2005). In the worst case it could lead to a politically motivated control of the masses, through issues such as surveillance and discrimination in data access.

To enable a pragmatic analysis of this complex domain, the next chapter develops and explains an analysis methodology with which to trace the institutional and technical considerations of urban information systems grounded in real-world cases and everyday life. Applied in my empirical studies, it presents a strategy for identifying institutional and technical considerations for new forms of participation. It follows what Lowndes and Roberts (2013) described as a 'sociological' approach to institutional theory. They point out that research endeavours using institutional approaches target the conflicting *political agendas* found amongst the various human and non-human participants in a complex social setting. This calls for an 'engaged' approach to institutional analysis in which the institutional analyst, through studies of institutions through stories, practices and rules can contribute to informed recommendations towards possible institutional redesigns.

Since the time of writing, I realised that the institutional view is possibly less dependent on 'heavy' and 'rigid' application of the conceptual frameworks set forth. Instead, an institutional view can be seen as an ontological lens through which to study a social system. This lens emphasises the various (formal and informal) roles participants perform in the instantiation, the making and remaking of infrastructure reconfigurations and how, in turn, instances of these interactions were negotiated in the first place. Scholars applying this framework could consider recent work following the 'infrastructure' turn in urban sociality that draws on sociomateriality, a view that urban infrastructures are instantiated time and again in myriad interactions between various human actors and non-human components (see for example Amit, 2014).

CHAPTER 4

USING INSTITUTIONAL THEORY TO STUDY DESIGNS OF INFRASTRUCTURES FOR PARTICIPATION

"Against the widespread assumption between the 1960s and late 1990s that electronic communications would necessarily work to undermine the large metropolitan region, all the evidence suggests that the two are actually supporting each other." (S. Graham 2004)

4.1 Abstract

In urban computing, citizen participation in the design of digital infrastructures emerges as a challenge for researchers and designers due to the diversity and complexity of their socio-technical context. Often there are various groups of actors, incompatible technologies, and interactions taking place across different physical and social sites. The design context is more fragmented and heterogeneous than usual for community informatics. We present a human computer interaction (HCI) methodology that uses institutional theory for the analysis of information communication technologies (ICTs), physical and digital information artefacts, and people in a particular context. Reflecting on its application to two cases in urban planning, we suggest how to 'trace' patterns of interaction with the existing ICTs and information artefacts, across social settings, time and geographic space. An interactive case study template ensures quality and internal consistency for comparative studies. For sustainable technical interventions, our approach underscores the importance of understanding the existing institutional context, and how it enables or constrains technical interventions that seek to support new forms of interactions amongst various community groups across time and geographic space.

***Keywords**: Urban computing; comparative methods; infrastructure; existing practices; institutional analysis; IAD; urban planning*

4.2 Introduction

Participation in the design of information communication technology (ICT) in the urban context presents researchers and designers with the "challenge (of incorporating) action and social change with design and development-orientated processes" (Bilandzic and Venable 2011). Setting aside the resentment in the smart cities literature towards 'top-down' approaches to systems development by commercial and public institutions (Hollands 2008; Staffans and Horelli 2014; Townsend 2013), achieving the economic and social sustainability of any technical intervention, particularly those involving a diverse and geographically fragmented user base, poses the challenge to balance the political and commercial interests of many different stakeholders (Ojala et al. 2010). Hence, large-scale interventions cannot be approached from single sites, touch points, individuals or groups (Monteiro et al. 2012) as they incorporate both, e.g., formal political institutions, and diverse sets of informal groups across a range of physical places.

For example, the Tenison Road project (Taylor et al. 2015) is a relevant case of innovative localised efforts of collating, storing, and managing data by a few households on a street in Cambridge (UK). Here local actors build a data archive of the historic residents, the everyday traffic flows along the road, and a range of other matters pertinent to that small area. Set into the wider scheme of institutional relations, the project offers interesting questions towards the use, sustainability and support of such local activities by city officials and other actors beyond their locality. Unusual for an urban location, the project exemplifies the location-contingency in community informatics and the difficulties of scaling the effects of the project beyond this place.

To address the challenges of comprehending and intervening in multi-site and multi-institution research contexts, we present a human computer interaction (HCI) methodology for informing ICT design based on institutional theory. Institutional theory underlies a realist philosophy that is suitable to address patterns of interaction established by documenting processes and relations. By involving actors relevant to a technical intervention in conversations about a shared problem context, the methodology provides a systematic analysis of the role of *institutions* and *technical infrastructures*. Here institutions refer to the established patterns of interaction in recurring action situations between people, ICTs and information artefacts. Technical infrastructures refer to the combination of various ICTs that facilitate an *information space* that is distributed across various physical and social sites.

Going forward, we present related work from HCI and outline participation as a key challenge in technical interventions in the urban context. We mention requirements of a methodology, such as appreciating the institutional ecology, accepting a messy technical context, actors' ambiguous goals, and supporting self-organisation by various actor groups. We explain the use of the institutional framework with several tracing methods to derive a comprehensive HCI methodology. In the final part, we discuss practical limitations that apply to the methodology and different philosophic underpinnings that can shape the study design and study-specific research question.

4.3 Related work on HCI methodologies

Bridging the chasm between the functionalities that are technologically supportable and those that are socially required has for a long time been a key intellectual challenge for the designers of collaborative technologies. In design practice, appreciating this gap was seen as an answer to the argument of the technological singularity, in which any present-day limitation of technology may be overcome in the longer-term (Ackerman 2000).

4.3.1 Collaborative technologies in the workplace

Early on in studies of computer-supported collaborative work, Grudin (1989) established that collaborative technologies in the workplace exhibit network effects because they rely on the participation of multiple co-dependent actor groups. Therefore, there exists a maturation point when the adoption of the technology becomes truly useful for various collaborator groups. Using the simple example of a meeting-scheduling platform, he explained how decision makers failed to consider the requirements of lower level employees, the largest and most important user group; and although it was well intended, when the technology became perceived as a hassle, some began to ‘game’ the system, undermining the usefulness of the technology to all groups involved.

Employees should not need to adapt to “applications”, interventions that become perceived as technical artefacts and unnecessary distractions (Grudin 1988). They should only have to adapt to “systems” which marry appropriate adaptations in the work patterns alongside the technical intervention. Others suggested that only “if the software changes cannot be performed by tailoring, a redesign-cycle has to be initiated. In this case one has to involve software developers to communicate the requirements” (Wulf and Rohde 1995).

Looking back at many years of design practice in a workplace context, Schmidt and Bannon (2013) reported three methodological advances in collaborative systems design. These include the recognition of the "situatedness" of practices in particular *contexts*, the “articulation work" required in establishing and negotiating cooperation, and the use of ethnographic methods to design technical interventions based on specific human practices in ‘context’. All the while, research on the resulting information systems has often remained confined to specific cases, social settings, and sites (Monteiro et al. 2012).

4.3.2 The design context in urban computing

Unlike the workplace setting, applications of ICT applied to the urban context assume cooperative technologies are ubiquitous and generic (Bilandzic and Venable 2011).

The nature of 'work' here includes forms of collaboration such as ‘crowdsourcing’ (Howe 2006) and ‘peer-to-peer collaboration’ models (Benkler 2007). Computing systems that support such semi-coordinated large-scale collaborative processes across social settings, groups and urban spaces challenge designers to develop technical interventions that can relate to the “community or societal level” of community informatics (Bilandzic and Venable 2011) and across various real-world places (Dourish and Bell 2007) while also relating to formal ‘institutional’ processes.

In doing so, as there are numerous stakeholders (such as planners and other officials, local neighbourhood webmasters, architects and developers, residents and their representative community groups (Saad-Sulonen 2012)) the question of who is involved at the design stage takes on a political dimension at the time when a system is deployed. Consequently, the chasm between technological capability and socially desired requirements appears in growing complexity and at a large scale. Understanding and designing technical interventions thus requires applying an "extended design perspective” that moves beyond specific technologies, social settings, or user groups (Monteiro et al. 2012).

Not only is the ownership over the existing digital infrastructures splintered among many actors (S. Graham and Marvin 2001); ICTs within the design space can also not be assumed to be compatible (Monteiro et al. 2012). These systems are ‘out there’, available to unspecified publics without the constraints of a formal organisation. Public policy, established laws, third party Application Programming Interfaces (API)s’ terms and conditions emerge as additional design considerations (Jackson et al. 2014). HCI design approaches are needed that embrace the “challenge of more open tasks, unanticipated user goals, new measures of system efficacy, and even conflicts among users in large communities” (Shneiderman 2011). Hence, Hollands (2008) calls for a “progressive” approach that puts citizen participation at the heart of determining desirable technological scenarios.

4.3.3 Designing collaborative urban interventions with communities in mind

In practice, distributing the ownership of a technical intervention between many different actors across various action situations is challenging. Ways need to be found for local groups to be included in infrastructure design choices that affect them (Weise et al. 2012). For the Tenison Road project we mentioned earlier as an example, designing interventions should be approached “in terms of an ecosystem of data forms for generating, viewing and possibly analysing data” (Taylor et al. 2015). In a case of community infrastructure development, researchers noted the irony that “ordinary people” whom the project organisers sought to empower were not represented in early design discussions (Carroll 2005). In another case, high turn-over within, boycott by, or resistance of key actors can be expected (Saad-Sulonen 2010b). All the while, developing and embedding any technical intervention is costly, requires private investment and specialist skills, and will thus almost always be mediated through experts, as opposed to being a completely 'bottom-up' citizen-driven process (Townsend 2013). This requires supporting experts to "creat[e] connections between [...] different tools" that become "both technical building blocks and artful integrations" (Saad-Sulonen 2012).

On the other hand, interventions that put community informatics at their heart, working in a very localised setting (compare Taylor et al. 2015), often struggle to scale up to make a 'vertical impact' that would influence change, for example, in the established (political) institutions and digital infrastructures beyond their control. Thus, community informatics, the study and embedding of ICTs with quite localised and context-contingent groups, "is a necessary but not a sufficient condition" (Staffans and Horelli 2014). As in meta-design (G. Fischer et al. 2004), community informatics needs to find ways of understanding the wider contexts *for* design, such as a formal institutional process. Previous studies underestimated the effect of engrained social structures that institutions provide in limiting flexibility, and hence failed to exploit the benefits of those structures for guiding and shaping the design and implementation of their technical interventions. Thus the role of institutions becomes an integral part of the design considerations (Monteiro and Hanseth 1996).

4.3.4 Analytical frameworks in HCI to capture context

To design interventions that fit to, take hold of and transform established computer-mediated collaborative practices over time, HCI researchers used frameworks to study computer-supported (collaborative) practices within their socio-cultural (and technical) context (Nardi 1996). The most popular frameworks, activity theory (AT) and actor network theory (ANT), are mentioned below. Studies that apply these frameworks, in particular ANT, often follow an interpretative philosophy that deconstruct the socio-technological design context in different and often detailed ways (compare Engeström and Escalante 1996). In contrast, institutional theory, described in the following section, has been associated with a realist orientation that closely follows practices and structures observed in the study context. We have provided a comparative overview of these methods below (see Table 4).

What we aim to highlight, is the shift towards action and change-orientated methodologies that follow design research methods (Goldkuhl 2012; Baskerville and Myers 2014) and that better match the approach to HIC design using institutional theory, which we will detail in the following sections.

	Actor network theory (Monteiro and Hanseth, 1996)	Activity theory (Bertelsen and Bødker, 2003)	Institutional theory (Hess and Ostrom, 2006)
Unit of analysis	Network of actants (including human and non-human actors)	Activity system(s) with goal-driven activity by subject (person/organisation) directed towards object (outcome)	Action situations and associated rules governing interaction with ICTs and information artefacts
Origin	Social study of technology	Anthropological psychology	New institutional economics (particularly study of natural common-pool resources)
Application	Tracing of effects of action and transcending the technological vs. social dichotomy	Recognising tensions between subject's intent, mediating artefacts, and object given a social context	Analysing governance of an information resource considering equity, efficiency, sustainability (in access)
Role of artefacts	Technology as inscription of previous practice. Artefacts have explanatory power - just as humans	Artefacts as mediators of activity and produced by previous activity. Interactions create context and artefacts	Part of 'physical' context. Humans shape rules for access to ICT ('facilities') which serve digital artefacts (enumerable objects)
Hierarchy & context	Single layer: flat ontology	Multi-layered: action composed of activity, actions, and operations / Activity contributes to shaping its own context	Multi-layered: Activity is shaping institutional context in which authoritiative influences are assumed (e.g. collective-choice and constitutional choice levels)
Examples	Callon (1986)	Engeström et al. (1996)	Schweik et al. (2013)

Table 4: Comparison of popular analysis frameworks in the analysis of context in HCI

AT views human interactions with and/or through digital devices as goal-directed activities within a socio-cultural context, referred to as an 'activity system' (Bødker 1990). Traditionally informed by detailed ethnographic work and thus a constructivist approach, AT integrates "the objective, the ecological, and the sociocultural" (Mitev and Howcroft 2011) where the socio-cultural context consists of rules, work organisation and culture. AT has been applied in understanding isolated instances of human-computer interactions, but is increasingly used to study group actors on a systems level, such as for organisational research (Bertelsen and Bødker 2003).

ANT maps out the relations amongst humans and various technical entities. It is far more deconstructive than AT as it postulates that "everything is a network". Approaches using ANT treat both humans and technology as equal parts within a social-technical network. It rejects hierarchies, group/individual, top/bottom, human/artificial binaries (Mitev and Howcroft 2011). In combination with ANT, AT breaks down the traditional distinctions between the 'technical' and 'the social' (Engeström and Escalante 1996).

What we criticise is, that AT and ANT draw on objects of activity and networks of actors respectively, but neither targets durable institutions and levels of co-dependent work organisation directly. ANT's outright rejection of hierarchy was critiqued as lacking values and may be analytically impractical (Mitev and Howcroft 2011). For AT, categories of rules, work organisation and culture were incorporated only in the 1990s when it became increasingly applied to information systems in an organisational context (Bertelsen and Bødker 2003).

A complementary institutional methodology suitable for the study of the structured social context(s) to human computer interaction seems warranted. Institutional theory is strongly intertwined with a realist ontology that follows underlying principles of social interaction. The approach to institutional theory developed by Ostrom (2005), for example, has been developed in the study of informal organising around natural resource dilemmas and associated phenomena such as 'free riding'. We see such a realist approach as deeply linked to pragmatist philosophy. As Goldkuhl (2012, p. 139) states: "The essence of a pragmatist ontology is actions and change; humans acting in a world that is in a constant state of becoming." Therefore, combined with suitable methods and a pragmatist philosophy, we hope that it becomes a vehicle for change in HCI research in complex urban contexts.

4.4 Characteristics of an institutional approach to HCI

In this article we suggest that the Institutional Analysis and Development (IAD) framework (Hess and Ostrom 2006) is a suitable 'complement' to established HCI frameworks (i.e. ANT and AT). Built upon studies of shared resources, the IAD presents strong foundations for capturing the institutional patterns between co-dependent constituents. Broadly, the IAD fulfils three important characteristics in relation to the requirements of the research context in urban design that we listed (including other forms of 'volunteer' based work, numerous stakeholders with often conflicting agendas, various ICTs that are fragmented in their ownership, and lastly the various open-ended user goals and conflict):

First, it is sensitive to the **institutional ecology** around co-dependent participant groups by probing for rules and hierarchical linkages. Participants' motives for (non-)participation vary as do their payoffs. Designers need to understand the incentives for (voluntary) participation (Grudin 1988). The IAD's definition of 'institution' as a set of rules and the search for sub-structures (holons) accommodate both interactions at the formal political level and the informal community group level. The designers can use it to document existing patterns for a technical intervention and to discuss desired future patterns, roles, and responsibilities.

Second, it accommodates the **'messy' information space** across technological, social, and physical contexts (Monteiro et al. 2012). The information space in the urban context consists of various ICT facilities and information artefacts in relation to a chosen social phenomena. Contrary to the emphasis on compatibility standards in infrastructures

(Monteiro and Hanseth 1996), the institutional approach highlights the use and governance of various (often incompatible) ICTs in combination. In citizen participation online, the 'embeddedness' (on the level of data exchange and design) of a technological intervention with other ICTs influences who participates (Albrecht 2006). A fragmented information space can thus hinder collective action. The institutional approach helps to identify opportunities for intervention.

Third, Ostrom's approach to institutional theory points to informal **self-organisation**, for example by community groups such as on the Tenison Road project (Taylor et al. 2015), as a tenet of collective action. The institutional view provides a 'theory of social dynamics' on why people engage in collective action (Healey 1999). Conceptually, similar to understanding the 'information space', collective action by individual groups contributes to system-level outcome. Outcomes of patterns of interactions present the context for future actions (Healey 1999). This reflexivity embedded within the IAD is important as it is part of the genealogy of existing institutional structures.

Given the political nature of such technical interventions, an institutional dimension to systems design is useful. It helps to understand the powerful inertia existing forms of social organisation perform on change in practice as well as the influence of laws and policies, as a codified regime of social organisation, on the success of technical interventions. The rest of this paper outlines the methodology, the progress of a study, and lastly two examples where it was used to understand the institutional design of information infrastructures for participation.

4.5 An institutional analysis methodology for urban computing interventions

The institutional analysis approach and associated Institutional Analysis and Development (IAD) framework defined by Ostrom (2005) was developed as a method for unpicking the complexities of 'institutions'. Those it understands as engrained patterns of interaction in recurring action situations between people, ICTs and information artefacts (Hess and Ostrom 2006). Over thirty years, Elinor Ostrom developed it meticulously by documenting the organisational arrangements in self-managed natural resource systems (commons) from which she identified seven governance principles for (informal) self-organised collective action. A key message of those principles is that for self-organisation to work, outcomes of such organisation need to be recognised and respected by high-level (formal) institutions (see the fundamental assumption of 'holons' later on).

Hess et al. (2003) adapted the IAD framework to the new types of digital resource systems enabled by the Internet, such as commons-based peer production and online repositories (e.g. Wikipedia), as these too depend on recurring participation in the authoring of digital information artefacts to remain relevant over time. It considers ICTs and related information artefacts as a human-made resource to be governed and highlights aspects (such as rules and incentives) that are important to support *voluntary* participation.

The IAD is applied as a multi-level map (Ostrom 2005). Ostrom (2005) breaks the social-technical system down into several *action situations* (for example a series of related events for which similar rules may apply) across different levels. This 'levelling' of the analysis is epitomised in the idea of the 'holon'. Quoting Koestler, she explains "The term 'holon' may be applied to any stable sub-whole in an organismic or social hierarchy, which displays rule-governed behaviour and/or structural Gestalt constancy" and thus "what is a whole system at one level is a part of a system at another level" (Ostrom 2005, p 11). For example, in the Tenison Road project documented by Taylor et al. (2015), the group of residents who self-organised a data archive and analysis of the traffic movements through their street should be seen as part of a wider network of actors including, for example, the traffic planners at the municipality. Their interests may be linked through the flow of traffic, and yet groups act in different action arenas associated with different rules, interests and incentives, facing the problem of traffic management from different standpoints.

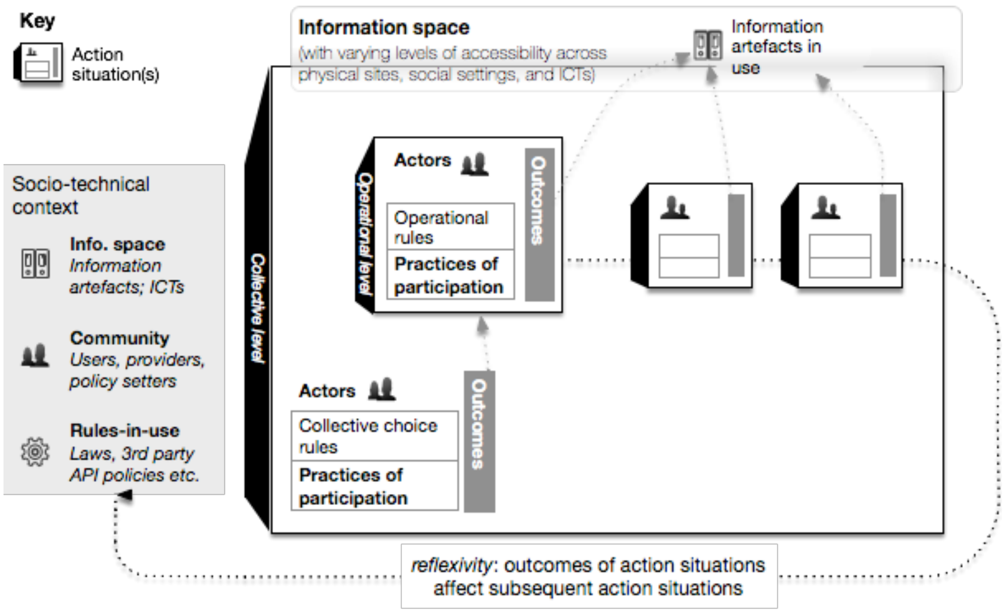


Figure 8: IAD framework adapted for information system analysis (adapted from (Hess and Ostrom 2011; Ostrom 2005)

4.5.1 Action situations as a unit of analysis

The IAD's differentiation of action arenas on different levels that have *authoritative links* (meaning that the outcomes from one action arena influence the rules of interaction from another action arena) is an expression where the idea of a *holon* is applied. The hierarchies in the kind of public engagement and participation that urban computing researchers are working with are both voluminous and complex, and full of such patterns. By studying interaction between a range of actors within the information system across "various locations on a micro-macro continuum" (Mjøset 2009), the problematic distinction between dichotomies, such as 'macro-level' and 'micro-level' is overcome as they are put in relation with one another. For example, a study could analyse the action situations for and across actors in the Tenison Road project (Taylor et al. 2015) and relevant city council officials.

In applying the framework, to articulate the relations amongst various action situations, we differentiate between the '*operational'* and '*collective choice'* institutional levels[51]. At the '*operational level*', outcomes of action situations affect the *content* of the information space, for example, through various actors' participation in the submission, evaluation and manipulation of information artefacts (e.g. files, documents, data). Conversely, on the '*collective choice*' level, action situations relate to *setting contexts* for participation, for example, by establishing the governance and configuration of the information infrastructure that enable interactions at the operational level. They include, for example, the participation in modifications to software code that would have implications for all users.

All other aspects are assumed as external contexts that present unavoidable constraints that cannot be affected without unusual efforts of the actors within the study but rather affect the present information system over time. This includes the development of national laws impinging on the social interactions within the information system or the service policies or configuration of a third-party technical system (Jackson et al. 2014). While actors cannot directly influence this context, they will have to make choices in interpreting how these external influences are relevant to them and how they are met through various practices.

4.5.2 Rules-in-use per action situation

Ostrom (2005) suggests a typology of seven rules when looking for patterns of interaction for individual action situations. According to her, "rules form a part of the

---

[51] Similarly, meta-design frameworks call attention to the meta level at which decisions relating to information technology are made to identify appropriate contexts for ICT design (G. Fischer et al. 2004)

structure of the situation rather than a solution to the (interactions) at that level" (Ostrom 2005, p. 61). Thus, the framework does not try to be *dogmatic* about what rules it expects. It merely postulates that any social context will exhibit some form of regularity in interactions that can be *traced* by asking relevant questions (see Figure 9). These rules, analysed through these questions, are useful in understanding the design of information systems in urban computing since they describe actors' different *roles* and associated capacity to act, access information and participate in decisions, and their incentives to do so.

The set of *rules-in-use*, i.e. 'governance', for action situations is relevant to technical interventions to understand *who* can currently influence the design of a technical intervention and *how*, and beyond that, *who* in the first place establishes those terms and *how*. *Rules-in-use* can be probed through seven categories and associated analytical questions (Ostrom 2005) to investigate the terms under which interactions between various social actors in particular contexts and involving various ICTs lead to collective outcomes (see Figure 9).

Roles for actors:	Which actors are there with which intentions and what's their relative strength in numbers?
Boundary rules:	How do participants claim these roles? If they are formal roles, how do they access and leave those?
Authority rules:	What can actors in their different roles do to affect the outcome?
Aggregation rules:	How are actions contributing to intermediary and final outcomes? Are there votes or does the decision reside with a particularly powerful actor? Is aggregation supported by a computer algorithm?
Information rules:	What guidelines or practices determine how information is communicated between whom and how? What information is accessible for participants in a particular position?
Payoff rules:	What benefits can individuals in respective roles expect? What criteria do they use to judge positive outcomes?
Scope rules:	What are the possible outcomes of the action situation? Are there any requirements (for example set by law) of what the outcomes should be?

Outcomes

Figure 9: The set of rules in use and associated analytical questions for probing the institutional context based on (Ostrom 2005)

In use of the IAD in urban computing, the *position rules* are used differently from the other six *rules.* Position rules establish the potential *roles* or *personas* that participants within an action arena may take on. From there on, it is possible to either focus in detail on how the other rules may differ in relation to these *roles* (for example, how does information access differ across a number of roles, admin, normal user, institutional user) but it may also be analysed in more general terms, by abstracting what sort of information rules are generally in place.

Rules may not be formally documented, therefore in the institutional analysis for HCI applied through ethnographic methods (Baskerville and Myers 2014), we like to place the emphasis on 'soft' rules, such as socially acceptable practices, habitual actions, actions that have been shown to derive beneficial outcomes, but also the known 'laws' of online participation, which recognise that usually 80% of activity comes from just 20% of all participants within an information system (Crowston 2011). In urban computing, Tobler's first law of geography is also relevant. It posits that things closer together in physical space are more alike than things that are far away (Tobler 1970) and hence we may assume that actors in action situations that are *physically* proximate are more related than those wide apart. Contrary to Ostrom's (2005) emphasis, we do not recommend 'parameterising' rules (i.e. forcing them into quantifiable relations) since the goal is not to model and predict, but to *document* and *understand* emerging patterns of interaction amongst various actors and ICTs within a specific context to *speculate* about potential interventions that provide a benefit, such as a faster process, greater satisfaction of the various participants and lastly *voluntary* participation.

4.6 Conducting the analysis

We now explain the *process* that we found useful when applying the IAD framework within an HCI context. In describing our approach, similar to Baskerville et al. (2014), we will loosely follow a narrative account of the *steps* in its application. Baskerville et al. (2014) propose a form of ethnography, called *design ethnography*, based on pragmatist philosophy, focused on change and active engagement of the analyst with his/her research context based on developing and testing prototypes. For the methodology, as described here, we do not preclude this aim, but point out that our experiences to date are from ethnographic studies *for* informing design, thus presently without the use of prototyping and technical probes. The methodology, as outlined here, accomplishes three of the six steps in *design research* described by Goldkuhl (2012) namely (1) diagnosing the research context, (2) establishing interpretive accounts from various research participants, (3) and, finally, *planning of actions* for future technical interventions.

Ideally, applying the framework alongside a range of suitable methods involves co-dependent actors from different stakeholder groups (for example community group, local authority, technology suppliers) in a learning process about *themselves*. In our experience, a combination of event chronologies (C), spatial data analysis (S), and retrospective interviews[52] (R) serve well as tracing techniques (see Figure 10). Easy-to-adapt and expand relational case study databases along with other specialist tools, such as a time-lining and geographic analysis software, can be used to consolidate data for the analysis and to support understanding. By doing so, a case-specific model of the IAD as well as a range of *visual research artefacts* are constructed that serve as probes for an interpretative phase with research participants.

The methodology we outline front-loads analysis steps that establish the 'bigger picture' (Pettigrew 1990). This can be achieved by studying the patterns of interaction through data logs from the existing ICT facilities first. Then, because the units of analysis in the IAD are specific action situations, it requires the "(isolation of) sequences of events", similar to process tracing in organisation research (Mjøset 2009). In our ethnographic approach, we thus trace participants' retrospective narratives of participation by involving individuals from different social settings and places in conversations with the analyst and indirectly with each other (Langley 2009). At least, if applied with a pragmatist tone, the analysis results in a set of recommendations (or hypotheses) of how technical intervention may be done and why it may provide a benefit. These assumptions need to be articulated by the analyst.

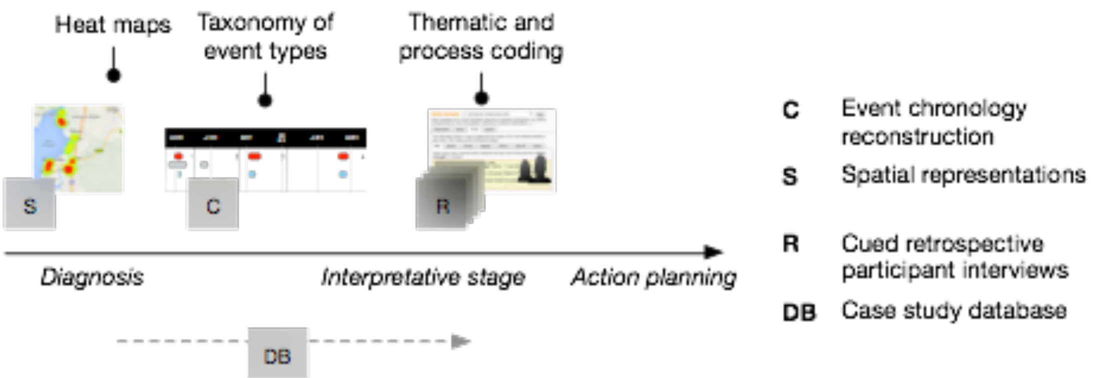


Figure 10: Generalized sequence of tracing steps within the analysis methodology

In the following section, we describe how to 'set up': mapping the bigger picture by 'diagnosing the socio-geographic context', understanding participant stories through 'process tracing', 'interpreting' and constructing specific IADs, 'iteration' between steps, and finally 'moving out'.

[52] Rather than retrospective cued interviews in HCI that often work with logging systems, video capture of interactions, eye tracking, and data reconstruction methods (Russell and Chi 2014), we mean retrospectives used in organization / process studies (see Langley 2009).

4.6.1 Engaging context and setting up

At the beginning we will have (1) a social phenomenon and associated information space in whose outcome[53] we are interested; (2) some thoughts on the process that led to those outcomes; and, (3) the context in which it occurred. We focus on *an outcome and process of interest* (Mjøset 2009), such as the development of a policy document (outcome) in urban planning (process). To establish *loose* bounds to the full extent of the case, we may focus on prominent activities to which co-dependent citizen groups contribute to and for which various instances of human computer interactions occur. What the analyst focuses on depends on his/her interests at the particular time. For example, at the outset we may want to know *how* planning decisions come about and thus we may identify a series of *public consultations* as relevant events (as in example case 1 presented later). On the other hand, we may want to ask why previous technical interventions failed and thus the focus of the analysis may be centred more on key action situations and the technologists involved on those projects (as in example case 2 presented later).

When engaging with actors within the study context, it is a benefit to build rapport with actors that are likely to have an understanding of the *bigger* picture of the process, and potential underlying principles and incentives of interaction. In an urban context, this might be an official, a community organiser, or a technologist who maintains an the ICT facilities involved. When building rapport, it then helps to move laterally onwards collecting additional data and facts about the research context as one moves in on various aspects in the study. Based on the material collected from archival data obtained from Internet searches or from actors directly, the creation of an easy-to-adapt case study database mirroring the available data (Annechino et al. 2010) facilitates understanding of key actors, events, places and technologies throughout the study.

4.6.2 Diagnosing the socio-geographic context

In the context of urban computing systems, understanding existing patterns of interaction requires an HCI approach in which the relative composition of different co-dependent actor groups can be understood at scale to identify the social dynamics between them (Shneiderman 2011). This is reflected in the IAD consideration for the nature of the “community” and the relative composition of actors in numbers (see “position rules”). Patterns of interaction that represent the wider social context can be best traced by studying archival data from existing ICT-in-use. When possible, activity logs

[53] Urban technical interventions involve tracing patterns of interaction with information spaces distributed across a city. Outcomes required by law are easier to identify, for example the production of local policy documents.

should be collected for any important ICT facility. Activity logs contain meta-information on the number of contributions made in a given action situation.

On the macro-level, associating the analysis with a geographic area, such as a city, is a sensible move (Townsend 2013) in contextualising the human computer interactions in relation to various places of interest. Community informatics underlies a strong attachment to place (Bilandzic and Venable 2011); most applications of computing to urban contexts rely on an associated geography of people and the materiality of their *places* (Foth et al. 2011). Based on outcomes from a street-level data gathering project, Taylor et al. (2015, p.2871) advise us "to think of structures that support some kind of representation of data's active presence in place. These might express how data travels geographically and between people, and when, where and with whom it gathers significance (traversing through the contours and across the boundaries of a social geography)". Geographical space provides a socio-cultural infrastructure for which digital infrastructures offer novel practices across the "local" and the "global" (Dourish and Bell 2007) levels of a system. Within that, places serve as powerful boundary artefacts for members of various communities (Healey 1999). Actors' location can be linked to other datasets (e.g. indices of deprivation, population density) to understand local specifics of various places involved in action situations (Steinberg and Steinberg 2006; Innes and Simpson 1993).

For example, for an in-depth analysis of the information space of urban planning in Lancaster (see study 1 in Table 5), we obtained a dataset from the ICT that the municipality use to store, manage and organise citizen comments on public policy documents. Based on detailed postcode data, we could map the spatial extent of the locations of citizens who contributed comments onto a municipal plan, as well as the locations that they commented on. The ability to 'sample' interaction dynamics across three major online consultations was a benefit to corroborate our understanding of the patterns of interaction for spatially distributed communities. Such simple analysis helped to establish the *spatial context* to existing patterns of interaction fast. Additionally, the exploratory analysis helped to set a sample frame for interviewing participants and determining the scope of the study. Where this is not available (see study 2 in Table 5), we need to account for the location physiology of the material contexts by describing any fragmentation in the localities of actors (such as whether it was a rural or urban setting as well as related demographics).

4.6.3 Process tracing

In urban computing applications, information systems are 'incomplete by design' (see Garud 2008). Organisational structures are never fixed, but continuously evolve over time (Langley 2009). In volatile (open) contexts, such as in applications of computing to urban spaces, the requirements for design cannot easily be set statically, but rather emerge evolutionarily from interactions with the information space presented by the phenomena studied. Citizens affecting the information space may come in, interact for a certain time period or lose interest and leave. They may interact frequently or sporadically, intensely or be rather apathetic, they may be remunerated or salaried to participate, but often participation is *voluntarily*. The distinctions between 'local' and 'global', 'digital' and 'virtual' are overcome in our approach by interviewing actors across various action situations and with different roles, including 'users' and 'providers' of ICT facilities, 'producers' and 'users' of information artefacts.

Besides a geographic sensitivity in the analysis, methods used in organisational studies, such as process tracing (Pettigrew 1990; Langley and Tsoukas 2010; Langley 2009; Mjøset 2009) are relevant here, combining "qualitative, ethnographic, and case-study methods" (Shneiderman 2011) so as to avoid a reduction to a "simple sets of rules and instructions" (Jackson et al. 2014). This is what distinguishes our approach from Ostrom's (2005) approach, which tried to formalise action situations into *models*. Across a range of *action situations* that make up the overall process(es) the analyst identifies the information artefacts[54], ICT facilities, and actors encountered there and determines *principles* that guide interaction.

It is good practice to try to map real, documented events with the knowledge of actors, ICT facilities, and information artefacts involved. For example, alongside the mapping of participants in the preceding section, we reconstructed an event chronology differentiating between online and a range of offline events, including recurring information events held by planners or workshops, as an abstraction of the patterns of interaction across the multiple social settings and sites over time. Following a reconstruction of the event chronology, stable categories now appear as changeable and, for example, the effect of introducing an ICT facility or information artefacts to the information space can be traced by the events that follow.

In respect to action situations, information artefacts may represent an (intermediary) outcome, that is so to speak part of the end product, but it may also represent descriptions or documentation of the *process(es)* that led to the outcome (Maher et al. 2011). In urban computing systems, technical interventions require tracing of

[54] Including "all those things that inform" (Buckland 1991), others have called it "digital media" (Saad-Sulonen 2012), but artefacts can also be physical (such as paper leaflets), and they may be interactive (dynamic charts) or static (text).

the information space(s) accessible to actors across action situations by their *actions* or, as Galloway (2004) called it, practices. Contrary to the many studies of sensor or display networks such as that of the Oulu display network (Ojala et al. 2010) or studies of digital networks (Bawa-Cavia 2011), the information space is defined by disintegrated, but co-dependent collections of information artefacts and people across different social settings, physical sites, organisations, and technologies. It is not 'clean', served by different ICTs owned or managed by different groups, thus providing inequalities in access often unintentionally.

4.6.4 Interpretative stage

After establishing participant groups, information artefacts, and ICT facilities (referred to as "constituents") grounded in archival data and initial conversations with key actors, a range of actors in different roles (officials, community representatives, technologists) are involved in retrospective conversations to investigate patterns of interaction across a range of action arenas. To review outcomes of their interaction over a longer term[55] (Hess and Ostrom 2011), we studied the patterns of interaction across a range of action situations (such as remarkable events) through the "rules" introduced in Figure 9.

Our method borrowed from process studies in organizational research to derive *narrative* accounts of participants' actions that may go back months or years (see Pettigrew 1990). Using event chronologies, maps of actors' places, images of workshops, and information on statements made in online consultations (related information on the time and mode of submission) helps those actors to recall details of their interaction with other actors, technologies and information artefacts in hindsight. Setting aside the visual cues (images about events) from archival data, as in Russell et al. (2014), adherence to a walkthrough from distance past to near present, face-to-face modes of interviewing, and avoidance of value-laden questions were helpful. We were mindful of the constraints of this method as memories of events blur over time.

Based on the experience of applying the IAD framework, we developed an interactive case study template to probe for institutional patterns in a comparative study of two technological interventions. The interactive analysis toolkit features the essentials of the IAD framework (see "IAD framework overview"). In cases where the earlier stages of

[55] For many urban computing cases, statistics such as participant retention are relevant to the understanding of the sustainability of the system.

context setting have to be abbreviated, it allows interview participants to frame action arenas that they found to have been of significance. For each action arena, the template then asks to list the ICTs, information artefacts and fellow actors involved. The template is applied as an interactive prompt during interviews to help re-articulate rules of interaction established across a range of action situations involving various ICTs, information, artefacts and participants. In our experience of this method of data collection, the interactive form, as well as the process of filling it in, were well received by interviewees. One participant commented, "I liked the way you document the interview with this structure that you have already prepared. That is kind of nice". The interactive interview performed well as a data-gathering tool, but the interview template does not undo the need for a qualified interviewer with some experience in applying the framework.

4.6.5 Iterative qualitative analysis

Throughout the analysis, a case study database helps to collate relevant information on the various constituents identified across a range of action situations. As new information becomes available, it will be added. This is an iterative process and helps in studies in which the analyst follows *along* with the case he studies and it is probably also good practice for design ethnographic approaches (Baskerville and Myers 2014).

In our cases, the IAD frameworks' rule categories fed into a subsequent qualitative thematic analysis of interview transcripts. Here, suggested rule categories became inductive concepts. On the other hand, a mark-up of the chronology of actions taken by participants over time, in particular official decision makers, corroborated the *genealogy* (see Baskerville and Myers 2014) of the constraints to use and access to information across a range of groups. To reconstruct patterns of interaction, Saldaña et al. (2012) recommend process coding to identify recurring interactions across a range of participants and action situations. They say recurrence is "both natural and deliberate – natural because there are mostly repetitive patterns of action and consistencies in human affairs, and deliberate because one of the coder's primary goals is to find these repetitive patterns of action and consistencies in human affairs as documented in the data" (Saldaña 2012, p. 5). In terms of rules relating to recursive action situations, we found it useful to group public outreach events into *series* of related events with very similar criteria as to who can participate and how. This also corresponds to the IAD's assumption of 'holons', meaning complete sub-organisations in themselves within the larger system of interaction.

4.6.6 Moving out and planning for action

Studies of the information space inevitably amass a large amount of heterogeneous data (e.g. qualitative and quantitative, geographically referenced, temporally placed) about individuals, places, ICTs and information artefacts. A structured database built as the analysis progresses serves to safeguard the consistency of the case study through organisation and synthesis of the underlying data (Yin 2009). For the multi-site, multi-institution research context of technical interventions in the urban context, databases help to consolidate data from different social settings, sites and technologies. As a support to learning, a case database thus can emerge as an imperfect, interactive representation of the patterns of interaction and the information space itself, capturing important properties, statistics for actors, ICT facilities, as well as information artefacts. Integrating information from within the information space in new ways, this facilitates the cross-linking and slicing of the data along different dimensions of interest (e.g. by events, participants, interactions).

We leave the analysis when sufficient information on recurring patterns of interaction has been gathered and when the *principles* of rules and roles of participants have been understood so that hypotheses can be formed for potentially beneficial interventions. The criteria for what is beneficial should be outlined and argued for in reference to participants' experiences. For example, in the first study, a set of similar rules applied to recurring public participation activities with individuals participating in similar roles with similar levels of access to information. As outcome of the analysis, we will have described the patterns of interaction, understood the linkages between the different institutional levels (operative and collective choice level) and derived a range of research artefacts, including event chronologies ('timelines'), maps of actors, photos and research databases. For documentation of potential alternate futures, the analysis serves as a basis for reflections for papers and reports that can be shared with the research participants for corroboration and to plan for actions, including potential future interventions.

4.7 Application scenarios: Information systems in urban planning

To demonstrate the methodology, we reflect upon our experience of analysing institutional arrangements for participation in urban planning in two different studies. Unlike traditional studies in community informatics, there are (1) technologists; (2) officials at formal institutions; and (3) various user groups, some of which are community groups. Thus, patterns of interactions in urban planning are influenced by formal (based on legal requirements) and informal interactions across various ICTs, and involve participants in the processing of large volumes of unstructured information. Using several 'tracing methods' (including geographic mapping, time-lining, retrospective interviews and comparative cases), we used the aforementioned analysis methodology to document interactions across multiple touch points, social settings, individuals and contexts.

In the comparative table (Table 5) below, 'duration' refers to the time that passed from data collection to the completion of the analysis; 'aim' summarises the study's goal.

‘Data collection and tracing methods’ refers to the methods used to trace the interactions among people, ICT facilities, and information artefacts. Lastly the ‘embedded unit of analysis’ describes the analytical focus of the studies.

	Study 1	Study 2
Duration	8 months	1 month
Aim	**Analysis of the existing information system — identifying opportunities for intervention.** Understand the perceptions of citizens engaging in urban planning consultations, the information processing practices by planners, and the existing “mundane” ICT facilities in use	**Analysis of two technical interventions — learning from outcomes of past projects.** Understanding the perceived technical and institutional challenges of embedding new forms of interaction in planning.
Data collection and tracing methods applied	*Participants out*: 21 retrospective interviews (with cues from archival data)	*Participants out*: interactive framework for data collection; two retrospective interviews (with prompts from archival data)
	Technology out: Case study database; mapping of location of 450+ actors; reconstruction of event chronologies	
Analysis methods	*Interviews*: Inductive (from the data) process coding *Archival data*: Deductive (from framework) coding of rules	*Interviews*: Inductive thematic coding of institutional & technical barriers *Interviews*: Deductive (from framework) coding of rules
Embedded units of analysis	*System-level*: Geographic patterns of interaction in producing a spatial plan;	*System-level*: practices and ICTs used by ICT platform operators;
	Participant-level: specific practices and ICTs at disposal to citizen contributors across seven action situations	*Participant-level*: practices and ICT used by community groups (sub-case)

Table 5: Comparison of studies undertaken with the institutional analysis provided in this paper

The first case analysed the various uses of ICT in the organisation of participation activities across a three-year municipal planning process, the use of citizen-supplied information by six municipal planners, and the resulting forms of participation used by 600 citizens. The process’s end products were two planning documents that listed the collective aspirations and intentions for the region (Banai 2012). The various ICTs involved in various participatory activities were often isolated and incompatible. Municipal planners used four separate online services. Thus, we were dealing with a heterogeneous and messy collection of ICTs and an information space that was unequally accessible to various stakeholders. Based on conversations with 21 stakeholders and data from a key ICT system, we determined opportunities for design interventions. The framework helped to differentiate several levels of participation through ICT (in shaping participation opportunities and shaping the content of the plans).

In this study, the IAD approach helped to uncover the way in which the planners established control over the participation process. For example, it showed that control of the evaluation of citizen's participation was down to one individual. Constructivist methods such as ANT would have tried to provide an explanation for why this was by reconstructing the relationship network instead of accepting it as a 'rule'. AT on the other hand would have been more likely to try to understand intents of action (such as the attempt to influence the planner) and as such the aspect of rules would have become a side aspect (in the analysis of the context to the interaction) as opposed to the *focus* of attention.

The second case presents the developed interactive template of the IAD framework[56] to efficiently collect comparative interview data for two technical interventions. Supporting the online interviews with the technological facilitators for each project, this method of data collection was considerably less resource-intensive. The compatibility of the framework with these two cases enabled a heuristic evaluation of the methodology as a consultative approach. Interviewees gave our data collection method positive feedback.

Differentiating between operational level (community groups) and collective choice levels (ICT operators), the framework helped investigate the factors as to why these technical interventions struggled to realise the forms of participation they sought to enable. The IAD's rule categories (particularly the category of *position rules* similar to a role playing game) and call to differentiate between distinct social contexts (for example, community groups' organisation and organisation of a technical platform), highlight how some actors perform different roles as they move between these social contexts. Such analysis demonstrated that 'success', as far as self-organised practices are concerned, would be measured by the degree by which actors providing the technical platform need not participate themselves in supporting the self-organisation activities..

4.8 Issues in application and analysis

Using the methods we outlined here, the IAD is useful for researchers and designers to notice and understand institutional aspects important for a sustainable intervention within the existing information space. In many ways, the IAD framework functions as a guideline for detailed retrospective analysis (example study 1 in Table 5), but it can also be applied in a fast (comparative) evaluation of different cases (example study 2

[56] The template can be downloaded: http://dx.doi.org/10.17635/lancaster/researchdata/18. It is distributed under a creative commons license and requires FileMaker12 database software.

in Table 5). For this matter we want to discuss several practical issues that apply to the use of the framework and highlight how the diverse and complex set of established practice(s) and technological set-up(s) can be interpreted in different ways.

4.8.1 Philosophies of application — interpretative or pragmatic

To tell the 'story' of an information space, a case analysis should cover, at the very least, its recent past. As pointed out by Baskerville et al. (2014), genealogies and associated archival research are part of ethnographies *for* design. In doing so, any perceived barriers, struggles or issues experienced by actors in their interactions can diagnose possible opportunities for intervention. One question that emerges is that of timing: How far back should the analysis reach to be meaningful? In other words, how many action situations should be added to the case study database?

According to Goldkuhl (2012), interpretivist and pragmatist philosophies form the basis for qualitative research in IS. Approaches from each can be combined. Therein "*either interpretivism is seen as instrumental for a pragmatist study or pragmatism is seen as instrumental for an interpretive study. This means that each paradigm can be the base paradigm allowing elements from the other paradigm to be used in an instrumental and supportive fashion.*" However, in terms of the *desired ends* of a study, we have to choose a direction. Choose an interpretivist approach if the research outcomes should purely be seen as theoretically interesting or a pragmatist approach if the research outcomes are believed to create "constructive knowledge" that may be useful in "action".

Principally, if the interest is purely aimed at generating knowledge that is *interesting* from a theoretical standpoint (see Goldkuhl 2014), then an in-depth retrospective study is worthwhile (an example of this is Engeström's study of the postal buddy system in the US, a talking self-help kiosk developed with good intentions for the US postal service, but which failed to be adopted (Engeström and Escalante 1996)). If the interest lies more in specifying actions for a technical intervention, then a long-range study can be abbreviated by a 'quick and dirty' ethnographic study with a limited set of interview participants on key action situations. It is practical to analyse the most recent action situation (for example, for study 1 in Table 5, the last out of a series of online consultations featured prominently). Additional context can be drawn in selectively.

An interventional use would be coupled with action research or design research (Mjøset 2009; Dalsgaard 2014). For instance, work by Saad-Sulonen et al. (2012) was an example for follow-along (interventional) studies. For several years, she tracked the use of an online platform for planning. In such contexts it is usually of interest to consider not only direct end-users, but also the needs of those sponsoring the technology, maintenance staff and operators. Design ethnographic approaches include 'potential rationing', in other words a design future possibility as well as co-design (Baskerville and Myers 2014). Here the interactive template of the IAD helps to ask essential institutional questions necessary to embed the technical intervention across various actor groups.

4.8.2 The role of participation

How then does this framework contribute to participatory infrastructures? How participatory should the process of informing the analysts' understanding of the information space be, and what role does the analysis have? The approach here is participatory in so far as it requires the consideration of a broad cross section of actors in different organisations, localities and roles to understand the information space. There are often resource limitations. The 'macro-HCI' approach, by which specific patterns of interaction are derived from archival data and existing ICT facilities, provides a template to inform which actors should be involved in the analysis. Nevertheless, it should include groups that, although underrepresented, played important roles in the proposed technical intervention.

The philosophy and assumptions of user empowerment found in the wide range of participatory design approaches to HCI, are essentially complementary to the analysis approach described here, but in addition our methodology emphasises the institutional context beyond the user. In many ways, the idea of this analysis is that we should 'slow down to go fast' and consider existing practices and patterns of interaction first before an intervention occurs. The analysis approach is a complementary toolkit for an appreciative enquiry, building links with actors, understanding their perceptions to ultimately prepare them for a collaborative intervention by facilitation of interactions amongst them. Participants in the analysis could become conversational partners and potential project champions who facilitate the success of an interventional approach that seeks to change existing patterns of interaction through technical support.

4.8.3 Building capacity — specified IADs for specific cases

The philosophical underpinnings of Ostrom's institutional theory differ from the traditional approaches in HCI. At its core, the IAD follows a realist philosophy being strongly concerned with the tracing of processes and rules. The realist philosophy lends itself to design research approaches, which feature a bias towards action and change (Dalsgaard 2014). In our own studies, whether it was the fragmented, heterogeneous information space (study 1 in Table 5), or the encounter of two platforms for new forms of participation which could not materialise into sustainable interventions (study 2 in Table 5), there is usually an element of capacity building involved and the assumption to distribute ownership over the technical intervention across institutional and community actors. Generating specified IADs for each specific case helps in multiple ways. It helped us learn about important challenges for a technical intervention (thus has practical relevance), it considers the aforementioned actors' needs (therefore has relevance for the intervention), and it has scientific relevance. It does so, since explanations for success or failure are found by tracing patterns of interaction. By comparing cases in different contexts (for example two cases of platforms for civic engagement in spatial planning) it is possible to generate substantive theories on good systems design. Ostrom's principles of good governance for sustainable common pool resources are one example (Hess and Ostrom 2011).

4.9 Conclusion

We argued that participation in design of urban computing services and their underlying technical infrastructure has emerged as an important challenge for collaborative systems design. Since urban computing interventions affect a large and diverse public, established laws, policies, and third party APIs' terms and conditions emerge as important design considerations (Jackson et al. 2014) and provide an extended design view (Monteiro et al. 2012).

Technical interventions in a public context must answer to the inertia of and opportunities for interventions within the existing institutional set-up and, as such, they should tell compelling and well-considered stories to be successful. At the core of the argument is that designers and practitioners in the field of urban computing should consider existing patterns of interaction as "interaction rules" between users, ICT facilities, and corresponding information artefacts when intervening technologically in processes for collective action. At the same time, researchers and practitioners may want to make sure that their intervention has the capacity to work with, as well as transform, existing practice along 'verticals' (thus from several small world cases all the way through to institutions).

We described an analysis methodology for urban computing that is based on institutional theory and relies on process tracing as one of the fundamental methodological techniques. It can be applied with predominant interpretative or predominant realist philosophies, depending on the objectives of the researcher. For this, we introduced the IAD framework (Hess and Ostrom 2006) as an existing, tested framework, and combined it with concepts and methods suitable to collaborative systems. Since the framework underlies a realist ontology, it is ideal for understanding the rules that encompass the various ICT facilities involved in any study. Institutional contexts require an appreciation of various levels of existing rules, whether implicit or explicit (e.g. laws) all of which provide constraints to designing interventions.

As the Internet and ICT facilities connected to it offer novel ways of interacting, the intellectual challenge for systems designers of developing and co-designing infrastructures for participation and open-ended goals reoccurs in great complexity. Attention to institutional contexts through ethnographic detail gives voice to the users, and transforms our view of what is required to sustain voluntary participation across various actor groups. In this process, urban life and living and the many relations between actors with *places* provides a common denominator for instigating action. Our mixed-method, multi-level methodology provides a necessary guideline to study the complex settings of day-to-day urban life and to propose design interventions accordingly.

Transition

Following on from the methods chapter, the next article takes up the example of the development of a spatial plan for the Lancaster District (UK) to illustrate the patterns of participation in relation to material changes in urban spaces. For this, the article relates instances of interaction of planning participants by geo-coding (1) actors and (2) the comments they made on sites within official online consultations. The fact that planners collate a diverse set of evidence on the local area, and store and process many citizens' comments and related personal data for a public purpose is reminiscent of the concept of community data in the position paper (CHAPTER 3). Interestingly, the analysis of the archival data brought to light clusters of activity in the local area that could represent new institutions' involvement in planning. This provides for an interesting power dynamic amongst actors within the case study area itself.

Primarily the article describes the social dynamics of participation in and about places within the process geospatially and addresses critiques of participation in planning being a-spatial although it deals with spaces and places (compare Royal Town Planning Institute 2014). The observed patterns of interactions amongst the 597 citizens included in the dataset are used to develop suggestions for technical interventions that seek to enable new forms of participation in urban planning. The social dynamics that the article describes serve as a critique for the planners' existing process and technical infrastructure. For further work it suggests the need to explore how local organisations, such as town and parish councils, influence planning choices and which ICTs they use for this purpose.

The article conceptualises local residents, here all those participants who did not state an official organisational affiliation alongside their comments, as place owners. On the other hand, participants partaking from outside the case study area, who were mostly representing professional organisational participants were described as *space controllers*. I appreciate that the case was substantially more complex. For the sake of this thesis, this categorisation needs to be seen within the specific local characteristics of Lancaster as well as the stark simplification of otherwise more complex relations between participants and their material contexts. First, the district of Lancaster has been described as featuring an unusually high number of long-term residents. Planners reported that the past decade saw fewer large scale developments than elsewhere in the UK. These characteristics have been attributed to the notion of 'place owner' as someone who, without formal ownership of a property feels nevertheless to have a vested interest in any material change in their environment. This concept of ownership has been described by de Lange and de Waal (2013, p.3) as the feeling that "that one has the right to act upon an issue. It is this sense of ownership that we are after: not a contractual, proprietary ownership, but a sense of belonging to a collective place, commitment to a collective issue, and willingness to share a private resource with the collective in order to allow other citizens to act, without infringing on other people's right of ownership".

The binary of place owners and space controllers should not distract from the main argument of this article, which is the complex spatial configurations of participants in the official planning consultation the plan sought to influence and their matters of interest within the material contexts of the Lancaster District. Through the geographic analysis of commenting patterns in relation to matters of concern in the study area, the article provides a sense of the attempts of influence taking, both by local actors as well as those actors participating 'remotely'. This view follows the call for a spatially integrated social science (Goodchild et al., 2000) in which a social phenomenon is considered in regard to its relationship with space. Doing so, the paper as presented here provides a substantial elaboration of this context as demanded by the institutional analysis methodology outlined in the previous chapter. A careful read through the forthcoming chapter equips the reader with the appreciation of a spatial dimension that will give the further qualitative analysis of this case additional depth in the following chapter (CHAPTER 6).

Looking back at each of the next three chapters and the ways in which results of the two studies contained within this thesis are documented, opportunities exist to further substantiate results by paying additional attention to the detailed 'backroom work' by actors in planning. Such detailed ethnographic attention could contribute towards the reduction of binary concepts indicated earlier. I made substantial attempts to provide a holistic account of instances of infrastructure modifications and use. Orlikowski (2010) suggests that such 'perspective of entanglement' would avoid attributing agency to individual actors (such as planners). Instead it would look for the capacities for action from a "relational, distributed" perspective rooted in specific instantiations, or events, of technology use. Arguably the studies provided emphasised those in official facilitation roles, such as the municipal planners, or the platform organisers in the secondary study. Future work would thus emphasise in greater detail individual, everyday practices of other actors and technologies interfacing with those actors. On the other hand, my studies add a new dimension to Orlikowski (2010)'s argument rooted in the attention to the spatial configuration of actors and articulate their continued influence on the formation of communities of practice calling to action specific instances of technology use.

CHAPTER 5

OF PLACE OWNERS AND SPACE CONTROLLERS — ROLE OF PLACE IN SPATIAL PLANNING PROCESSES

"The rhetoric of seamlessness (in pervasive computing) is often opposed to the inherently fragmented nature of social and cultural encounters with spaces; we need to be able to understand how pervasive computing might support rather than erase these distinctions." (Dourish and Bell 2007)

5.1 Abstract

Using archival data on citizen participation in a case of municipal spatial planning in the UK, we focus on the physical context for citizen participation apparent in two online consultations. This was done by geo-referencing participants and their places of interest. The data archive consisted of 2448 documented instances of participation (comments and meeting attendances) by 596 citizens from various walks of life. Analysis of the archival data found that local residents without organisational affiliation (dubbed as 'place owners') were largest in number and closest to the sites, but had a lower influence over the content of planning documents. We argue that explicit consideration and articulation of spatial relationships in institutional (engagement) practices and the ICT facilities could support participation by the local, indigenous population. Explicit consideration and articulation of spatial relationships could improve the available information space by supporting collective awareness, local activism, and by helping 'place owners' understand[57] the urban planning process. From the point of view of the municipality, such approaches can support the distinctiveness amongst localities within their jurisdiction. By helping actors understand conflicting expectations towards various places, self-organisation on shared matters of concern could lower the administrative and coordinative burden of municipal planners.

5.2 Introduction

In the past ten years, spatial patterns of user-generated content production have received increased attention. Geographers, such as Graham (2004), reminded researchers

[57] A previous version of the article used the term "socialise" to indicate that it is not just about understanding the planning process, but changing it so that barriers to participation are removed and participants can engage in more direct interactions.

not to forget that user-generated content on the Internet remains dependent on *real* people in the *real world*. Advanced, widely-used geo-social[58] platforms and the adoption of location-enabled devices have rendered the overlay of software code and physical space increasingly obvious (Zook and M. Graham 2007). For citizens, this gives rise to unsolicited, context-dependent impressions of space mediated by its various virtual representation(s) as co-created information often in real-time (Kelley 2014). Various information communication technologies (ICTs) therefore assume a significant but understudied capacity in the adaptation of urban space.

In relation to technical interventions, at least two streams of work have focused on physical space and social activity online. On the one hand, projects in urban locative-media art and location-based games, from the mid-2000s onwards, were amongst the first to blend online participation with physical interactions (M. Graham et al. 2013). On the other hand, studies of online social media platforms provided interesting insights into the social dynamics of mass communication, but have often remained ambiguous about the social contexts they encountered[59] due to a lack of contextualisation to specific social problems 'on the ground'. In our article, we follow Graham's (2004) suggestion that other types of 'user-generated media' can be found in less technically sophisticated contexts to demonstrate the link between physical space and its virtual interpretation. In a similar manner, Galloway (2004) used the term 'transduction', suggesting that technology-mediated practices change so that one practice (of content production) gradually transforms and blends with another. An example of this is formal participation in spatial planning[60] where a clear link to physical space exists.

Studying the links between 465 citizens and 178 sites in two online consultations on a spatial plan, we show the value in analysing consultation data to document participation in and about physical space. Unlike the planners who treated each contribution individually, we can ask what role physical space[61] plays in the geographic

[58] 'Geo-social' platforms describe a family of online applications that explicitly consider spatial as well as social relations. Examples are FourSquare, Yelp, Google Maps, and others.

[59] They developed footprints of cities (Bawa-Cavia 2011), described chatter from certain neighbourhoods of London (Quercia et al. 2012), and analysed the diffusion of different languages across Europe (M. Graham and Zook 2013).

[60] Also known as land-use planning

[61] To conceptualise ownership of place in our discussion, we draw on the 'space' and 'place' distinction (Harrison and Dourish 1996). Locations in physical space come to be a 'place' through the collective meaning of its users. Physical space, on the other hand, emerges as a social infrastructure for the participation in places of interest (Dourish and Bell 2007).

distribution of citizens and establish the patterns of participation in relation to various places. Based on the study of the citizens and development sites (viewed here as matters of shared concern) we offer informed speculations for the design of technical interventions that foster greater collective awareness and local activism through future technology mediated practices that draw on the physical space as a boundary artefact (Star and Griesemer 1989) in an improved information space.

5.3 Relevant literature

Next, we elaborate the distinction between ‘place’ and ‘space’ in relation to planning and information systems design. This sets a frame for our article, which implicitly focuses on the various powers of contributors in spatial planning. Then, relevant to our discussion, common patterns of participation in planning are introduced. We conclude the review by emphasising the possible roles of technical interventions in enhancing social interactions with space.

5.3.1 Place and space

In studying the role of physical context for social activity, scholars differentiated between the concepts of ‘space’ and ‘place’ (Harrison and Dourish 1996). In this understanding, parts of geographic space, locations or areas, emerge as a ‘places’ if citizens have meaningful social interaction with them.

Thus, ‘place’ is understood as a socio-cultural phenomenon. As Harrison et al. (1996) pointedly put it "while *spaces* have up and down, left and right, *places* have yesterday and tomorrow, good and bad." This implies that interaction with places, as culturally significant parts of physical space, change the meaning of those places over time — a historical trajectory documented in written accounts of the past or embedded as 'local knowledge' in the minds of, what we might call, place users. Through those interactions, diverse interpretations of a physical location may emerge. In architectural practice, experiences of and memories associated with a place present important cues for understanding its functionalities and uses (McCullough 2013). In terms of the study of collaboration, places may function as shared references where the various different “readings” for a range of citizens intersect (Healey 1999).

Should physical space then solely be seen as an objective and ‘neutral’ ground defined by physical orientation and measurable distances?

While space was most often associated with measurable geographic properties and insurmountable distance in work in computer science, it has similarly been re-conceptualised as ‘social-cultural infrastructure’ for social interaction (Dourish and Bell

2007; Dourish 2006). Recent studies in computing indicate that the unit of analysis for spatial phenomena has shifted 'upwards'. For example, various studies analysed urban spaces based on digital data (Ratti et al. 2006; Zheng et al. 2011; Bawa-Cavia 2011; M. Graham and Zook 2013). Hence, analytically and conceptually it has become feasible to view urban development as "effectively produced and created through social actions within and between places" (S. Graham and Healey 1999). Dourish et al. (2007) noted that the "material and physical circumstances" of social interactions with and through digital technologies are important. Space can no longer be simply understood as an immutable "passive physical container" for ICT application.

Due to the multiplicity of uses and understandings, both place and space are entangled in power relations. Importantly, this distinction implies a subjectivity in what may be a meaningless place ('a space') or a space of special quality ('place') for different individuals. In terms of the intermediation of information communication technology in planning, the geographic dimension is an important factor. For example urban computing seeks to combine the "intersection of notions, trends and considerations for *place*, technology, and people" (Foth et al. 2011) in which physical context unavoidably gains a prominent role. Therefore designing technical interventions in planning, and later also governing those systems, requires greater spatial awareness. To do so, it is important to appreciate existing patterns of interaction (see CHAPTER 4).

5.3.2 Social dynamics in spatial planning

As a political process, interactions of participants in planning are defined by country-specific laws, socio-economic circumstances, and possible uses for a limited amount of land, amongst other factors. Amongst different types of planning, spatial planning is concerned with decisions that affect *places* inhabited by people by allocating land for different uses. As mentioned before, mediating the different readings of places, in planning, places often emerge as sources of intense conflict for a range of individual and group actors (Healey 1999). What describes the social dynamics of participation in planning in relation to places?

Because of its complexity, antagonistic character, and technical barriers, large-scale participation in formal urban planning commonly involves only a small segment of local residents. Individuals and group actors from within the local community may lack the financial or professional capital, and subject expertise to fully engage with it. Hinting at barriers in participation, Cilliers et al. (2014) argued that the focus during the official planning processes is often limited to "conceived space" presupposed by actors outside the place itself. Planning, they note, does not easily favour the "people scale of planning" and as a consequence the institutional processes with their focus on online consultations may exclude many people. This can be problematic if local, indigenous knowledge[62] of places is the key source of contribution that such groups can make (F. Fischer 2000).

Planners play an interventional role in mediating between the different understanding(s) of and power(s) over places, that various groups hold (Forester 1989). Through writing proposals and policy documents (such as “plans”), they facilitate foresight, taking the present into consideration. Participation of various citizen groups has gained importance in most Western societies (Cullingworth and Nadin 2006). Planners carry the obligation to reach out to the various relevant public(s), which at first may appear as an unknown but ever critical audience, in search of solutions that suite the publics’ needs (Seltzer and Mahmoudi 2013). Planners’ work occurs within tightly set rules (such as legal frameworks) and constraints (such as national policies and the socio-economic context). In the UK, which is home to this case study, the planners’ intermediary role is constrained by the leverage of special interests, the influence of central government (Healey 1999) and a lack of emphasis on place (Royal Town Planning Institute 2014).

Planners, however, do have powerful means of structuring participation locally in different ways. In analysing the interactions between planners, civic groups, developers, and politicians, a Finnish survey of 3,600 participants in planning consultations suggested that planners had a stronger link with developers (Falleth and Hansen 2011). Furthermore, developers had an advantage over civic groups by being involved in early "formal, closed meetings" with planners. Local politicians were better linked with civic groups that represent the visible, organised “long-tail”[63] of local place owners. Generally, local residents were found to be poorly organised, often with widely differing viewpoints on the same project. An actor network study of plan development cases in the UK found that although planning was heavily influenced by national policies, planners’ interpretations caused variation in their application in different localities (Tait 2002). These studies suggest that the nature of citizen participation will naturally be somewhat location-specific because planners will implement laws differently[64].

[62] This knowledge includes the lived experience and understanding of what works and what doesn’t work at a place, held by citizens who frequently use them over a longer time, and are thus the experts within their own microcosm (F. Fischer 2000)

[63] By ‘long-tail’, we indicate those groups that present generally low levels of participation over a great number of individuals.

[64] Cullingworth et al. (2006) reiterated that the UK planning system draws more on discretionary outcomes (and therefore less formal processes) than other European countries.

While studies of planning systems increasingly considered the patterns of interaction in planning in comparison to studies of online social networks, the line of enquiry into various actors' participation in relation to their physical locations in formal planning processes is underdeveloped. This is surprising given that 80 percent of online content is geographically linked (Hahmann and Burghardt 2013) and citizens are increasingly searching for information related to their geographical context[65] online (NESTA 2013). The lack of consideration of physical space in consultations and policy making remains a conundrum in formal spatial planning in the UK (Royal Town Planning Institute 2014). Conversely, empirical studies of participation in planning should study the *physical context* of participants in planning.

5.3.3 Mediated experiences of places

Studies relevant to this gap are now often found in disciplines that concern themselves with online-based ICT platforms. As the first study in a series of experiments on urban analysis, the Mobile Landscapes project at MIT[66] mapped mobile phone locations in Milan from a large communications network (Ratti et al. 2006). In a different study, Bawa-Cavia (2011) visualised the self-organising characteristics of the cities of London, New York and Paris by using FourSquare data. It was suggested that real-time data from similar locative networks could supplement traditionally cumbersome city council surveys, offer new snapshots of the city as a living system, and enable 'ad-hoc' practices of participation at the same time. There is mounting evidence that such "new forms of contribution" as found on geo-social platforms could motivate citizens to contribute if tasks are close to their home or other popular places (Alt et al. 2010). For now, such scenarios remain future visions for institutional, 'formal', processes of participation.

Studies on online collaboration shed light on expected 'usual' patterns of interactions online that provide the seed for new forms of participation. Considering patterns of online-mediated political participation relevant to Hamburg (Germany), Albrecht et al. (2006) recommended that to understand social dynamics, researchers should de-emphasise the focus on the individual by drawing on "theories of mass-communication". In their study of online participation for Hamburg's vision, 538 users made 3907 comments over a time frame of four weeks. Typical for online content, participation levels were highly unequal and 20% of all users made 75% of all contributions. Although relevant to Hamburg as the overall geographical focus, they

[65] look for the respective Google statistics.

[66] Massachusetts Institute of Technology

tended to disregard the physical context of participants. In a study that aimed to develop street furniture for a city in the USA, Brabham et al. (2010) described how the Internet facilitated submission of designs globally. More than one third of all 338 registered users came from outside the USA (Brabham et al. 2010). In the future, the sophisticated methods of the spatial humanities (see M. Graham and Zook 2013) that map patterns of interaction on social media geographically, would be able to provide rich insight into the social dynamics of participation in the planning process.

5.4 Methodology

To study the patterns of participation in planning in relation to various places, we geo-coded consultation data and employed approaches from geographic analysis. A review of 304 papers of community studies found that few provided convincing analytical methods that could capture the participants' context well (Luke 2005). Luke (2005) identified spatial analysis as part of a canon of quantitative methods suitable for considering context by describing "the influence of ecological, environmental, or group-level factors on individual-level behaviour." Proposing a "spatially-integrated social science", Goodchild (2000) argued that explicit consideration of physical space in analysis of social interaction is desirable for a number of reasons: First, most data (on the Internet) contain geographic references; it is thought to be 80% (Hahmann and Burghardt 2013). Second, computing power and techniques for collection, management, analysis, and processing of geographic information are now universally available. Third, geographic references help to integrate various datasets and thus facilitate interdisciplinary research. Lastly, understanding the variations in a social phenomenon specific to places enables development of locally-relevant policies[67].

5.4.1 Data source for this case study

For the preparation of a spatial plan, planners organised four participation stages across a time frame of three years (see Figure 11). In particular, the online consultations in mid-2011 and late 2012 were mediated and supported by digital technologies. In these two consultation stages, citizen participation was largely limited to formal commenting on written drafts either by email, online, or postal letters. Citizens could make suggestions, ask for amendments and voice objections. No legal restrictions to participation existed,

[67] For example, large corporations used similar techniques in identifying ideal store locations where a set of desired criteria are met.

meaning that any citizen who wanted to could, in theory, comment during the public consultation.

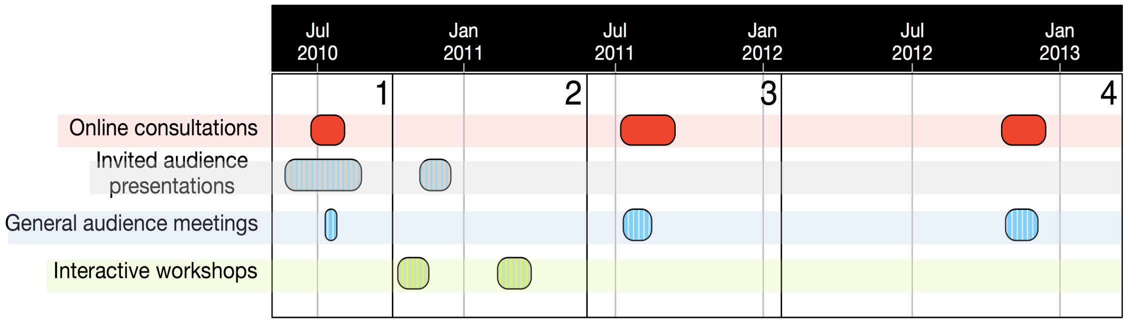


Figure 11: Timeline of instances of participatory events[68]

Our dataset is based on archival records of citizens' comments in the main consultation stages (red bars in Figure 11). For that, we obtained **five** consultation outcome reports. These listed the citizens' name, postcode, organisational affiliation, their comment(s), a reference to a position in the policy document, and officers' response(s). In a database software[69], we integrated statistics across the consultation stages and linked the dataset to other relevant information (e.g. census data per location, study participant demographics, and interview records). Overall the database included 2448 documented instances of participation by 596 citizens. While our case consisted of two documents that were prepared in parallel[70], the analysis in this article exclusively considers the spatial planning document. This document directs where homes, employment land, services and future investment will go. This focus narrowed our dataset to 1160 comments by 465 citizens (the "data corpus").

5.4.2 Data preparation

Geo-parsing of comments. Using a council-supplied list of unique site identification ("site ID") numbers (273 sites in total) as input, an automatic search script identified mentions of these formal site references within the data corpus of citizens' comments ("contributions"). In a second step, we reviewed the output of the automatic geo-parse

[68] The bars for interactive workshops, invited audience presentations, and general audience meetings summarise a range of related events. The bars for online consultations indicate the number of weeks a consultation was open.

[69] FileMaker Pro

[70] The case study also included interviews with twenty-one participants, including four planners. While not directly considered, the insight from these interviews supports profound understanding of this case (see CHAPTER 6)

manually for all 1160 comments. If the comment included erroneous or misspelled site references, we noted the correct site references in a separate database field ("references"). Likewise the appropriate site ID was noted if a site was mentioned by its name. In this manual geo-parsing process, the meta-data and content of comments was taken into consideration: The spatial plan contained sections that were either (a) general in nature (e.g. introduction), (b) single site, or (c) related to multiple sites (latter two are "site-specific"). We examined comment-associated meta-data to identify whether it was made on a *site-specific* section in the draft plans. This was registered in the database and finally the automatic search script was run one last time on the "references" database field. As some comments mentioned multiple sites, the process resulted in 1379 comment-site-references that were stored in the database for further analysis.

Geo-referencing sites: The centroids, or midpoints, for the shapes of each of the 276 sites served as its geo-reference[71]. Centroids were calculated and stored in our database as latitude, longitude pairs. Using the formal site database, as opposed to the many additional implicit location references within comments, had advantages in geo-referencing of places of interest: First, it greatly reduced the complexity of the geocoding process as only a small number of specified places (273 sites) were included. Second, their association with site-specific policies helped to associate a *primary intent* with individual comments amongst the other implicit location references (e.g. street, town, and place names). Thirdly, exact locations for formal sites could be calculated for enhanced accuracy (Hecht and Gergle 2011). This way our analysis is based on information with good distance accuracy even at low spatial scale.

Geo-referencing citizen contributors: The database included postcodes for the majority of the 596 citizens that participated in online consultation or events. For spatial analysis, only citizens with full six-digit UK postcodes were geo-coded and included as latitude, longitude pairs in our database. This was the case for three-quarters (74%) of the 465 citizens[72] who commented on the spatial plan. For most of the others, the general area (e.g. "Lancaster") was known. The combination of, firstly, site location supplied by the council and, secondly, detailed postcode information for citizens permitted us to link the locations of citizens with the locations associated with their comments. The outcome was

[71] We acknowledge that the centroids may introduce a bias. That is the case because the size of sites varied. Citizens may refer to particular points within a large site. We accepted this as an acceptable limitation to our analysis.

[72] For a further 11%, four or three digit postcodes were known.

a citizen-comment(s)-place(s) link table that included 7743 citizen-comment(s)-place(s) relations, of which, however, only formal place references are considered.

Grouping citizen contributors. For comparison purpose, 465 citizens were grouped along two dimensions into ten participant groups. We distinguished between Lancaster and non-Lancaster-based citizens ('Lancaster-based' were all postcodes that fell within the Lancaster district[73]) and organisational affiliation. Stated organisational affiliation suggests professional interest and therefore the organisation's agenda. We registered 119 different organisational affiliations: For commercial entities on the UK's Companies House registry[74], Standard Industry Classification (SIC) codes helped differentiate between development-focused companies (including consultants and property developers) and other businesses (e.g. energy, ICT companies). Organisations not registered with Companies House were classed into either government-affiliated public bodies (e.g. the Coal Authority, parishes, district council) or special interest groups (informal community groups or registered charities). The result of the grouping is included in Table 6.

	Lancaster	Non-Lancaster	
(No affiliation)	295 *(residents)*	49 *(no affiliations)*	346
Government	12 *(parishes)*	19 *(county, Environment Agency etc)*	31
Businesses focused on development	7 *(local developers, consultants, etc)*	34 *(local developers, consultants, etc)*	41
Other businesses	7 *(local ICT company)*	11 *(utility companies, local harbour operator)*	18
Special interest	17 *(Friends of Freemans Wood)*	11 *(Sport England, English Heritage)*	29
	338	**124**	**465**

Table 6: Participant matrix by location and type

For conceptual purposes, we considered Lancaster-based citizens without organisational affiliation, the "residents", as the *place owners* of the different physical spaces within the Lancaster District. Remote contributors, including many consultants and developers, were considered as *space controllers* within this article. They often stood in for landowners or have some other formal authoritative capacity. The grouping suggests that in this case most citizens with organisational affiliation, particularly the developers, were

---

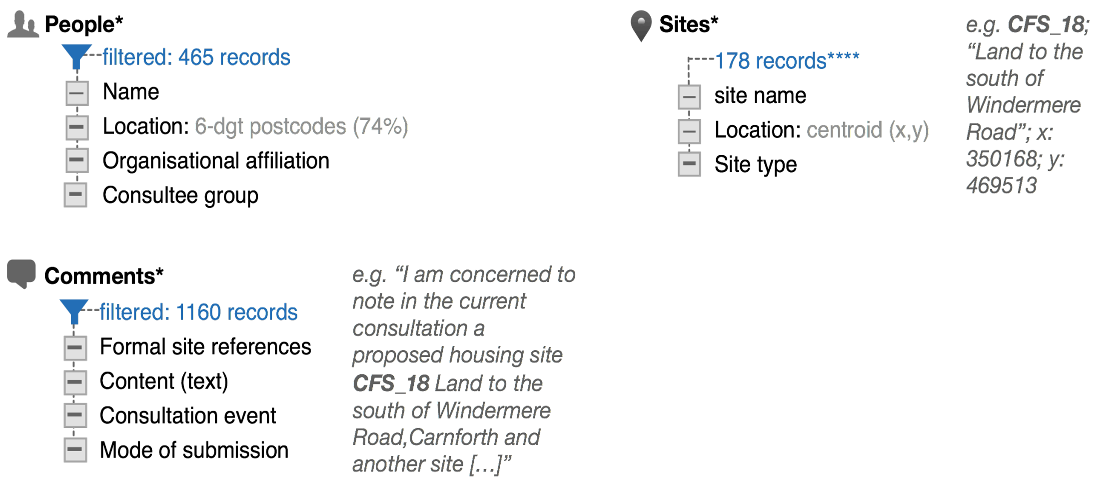
[73] Lancaster is part of the county of Lancashire in the North West of the UK. It is largely rural with two major settlements, Morecambe and Lancaster, that together comprise 120,000 citizens.

[74] http://www.companieshouse.gov.uk/

located outside the study area[75]. Our analysis could not consider the locality of land owners.

5.4.3 Final dataset

Figure 12 summarises the data structure after data preparation as well as some exemplary content. For the original dataset, we passed the comments made by the 465 individuals through a natural language process. It identified topics in the citizens' contributions, which were originally used to develop an understanding of conversation topics per group. Since this was not key to the analysis in this chapter, it has been supplemented as an appendix (see APPENDIX V).



Data sources: * Lancaster City Council (2013); ** AlchemyAPI query; *** UK government (Ordinance Survey & ONS); **** 273 non-unique sites across two consultations

Figure 12: Data structure of the case study database used in the analysis

5.5 Case analysis

The focus of this case study is the Lancaster District, located within the North West of the UK with a diverse population of 138,000 inhabitants (Office for National Statistics 2011). The diverse mix of urban/rural, deprived/affluent, settled/temporary residents makes the district difficult for planners to understand. In recent years, the area has enjoyed the benefits from a growing local economy. A favourable population and economic outlook required additional urban expansions. Planners tried to explain to the local public that welcoming a growing local economy, more local jobs and residents, required further house building.

[75] We might expect this to be different in a larger metropolitan area.

Through a complex demand and supply study of Lancaster District's property market, consideration of demographic trends, and a number of other factors, public planners in the local administration had set a broad target for house building in the district within the next five years[76]. Based on the planners' survey and government requirements, at the time of this research, space for 5000 developments would need to be identified to cover expansion and redevelopment of existing settlements over the next ten years. Given that space for building further houses in the district was constrained by flood risk zones, heritage regulation, and nature preservation areas, at the outset planners organised five spatial workshops in early 2011. This presented an opportunity for 59 local residents to attempt to allocate these 5000 homes on a map indicated by poker chips (see Figure 13).

Figure 13: Citizens participating in a mapping workshop to allocate sites

In the process, most local residents preferred not to release empty greenfield sites close to existing settlements for future development. There was a consensus that the many brownfield sites in the district (including old industrial estates and other derelict

[76] UK planning law requires local authorities to prepare and document a five-year housing supply. The level of this housing supply is determined by a complex demand and supply formula and is based on local surveys including the census and information on the housing market.

build-up areas) should be redeveloped before any other greenfield (i.e. previously undeveloped) land would be released to developers. For developers, the development on greenfield sites (without prior contamination of structures) is easier and more profitable. Consequently, this meant that the allocation process was an especially wicked problem with great conflict potential[77]. For example, a local resident, who was an above-average contributor to the various consultations, thought that "there is clearly a battleground between brownfield priority areas and the release of attractive greenfield sites on a large scale", or in other words, between developers who prefer 'fresh' sites and local residents who prefer development on previously used sites.

These early planning workshops marked publicly the beginning of the drafting of the spatial plan and determined which sites would be suggested in further stages. Planners took the results of workshops with place owners and drafted increasingly advanced versions of the spatial plan with additional consultations in mid-2011 and late 2012. Thus, the data in this article is based on the two online consultations that followed the early participation activities.

Based on this case, we were interested to understand the role of physical space in the participation in this contentious process or, in other words, the place-space nature of participation of local residents as place owners, and remote participations as space controllers. Providing an opportunity to understand established patterns of participation and their power dimensions, we set out to ask which patterns of interaction become apparent amongst those participants in spatial planning. Given that the district is semi-rural with a number of neighbouring villages beyond the main urban core, we expected significant local activism.

The following case analysis is structured into five parts. First, we map participants' locations to establish from *where* influences on the local plan originated. Second, we study the distances of contributors to the *physical locations* they contributed to. Third, we focus on the popularity of sites, studying the share of local participants across the 'Top-10 sites' and identify patterns of participation in relation to three activity clusters. Fourth, we look into indications of local self-organisation. Finally, we study the *power and influence* of contributions from local and remote participants.

[77] A resolution is found by agreement. However, because the allocation of sites meant that a site would be developed in the future, it raised a great amount of interest and resistance by various local groups for various reasons (such as development on greenfield sites, worry over traffic, spoiled landscapes, equity of allocation between urban and rural areas etc.

5.5.1 Patterns of local activism and reach of influencers

The first step in the descriptive analysis was to map the geographic locations of participants to understand the geographic distribution of place owners and space controllers (see Figure 14). We used a technique of cluster mapping, in which spatially proximate contributors are aggregated and indicated by their numbers. Doing so, we developed an understanding of the geographic expanse of the overall community of citizens[78] that participated actively by commenting in the two online consultations.

The resulting cluster maps indicated the intensities to which different geographic areas were involved in commenting on the documents. Through the geographic analysis, we can draw some thought-provoking insights into the 'global-local' links and the wider social dynamics of citizen participation in which policy making for Lancaster is embedded.

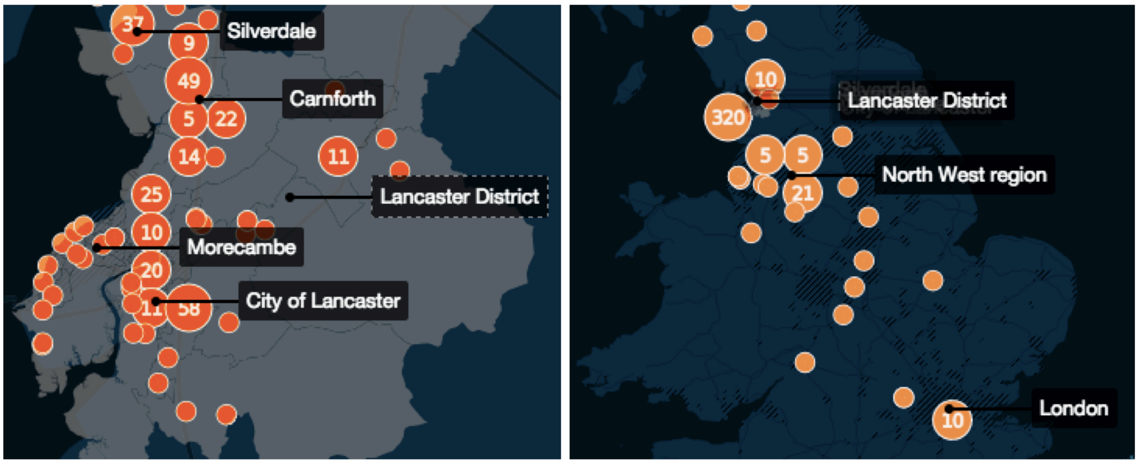


Figure 14: Cluster map of citizen locations (Lancaster District and UK wide)

In this case, all 465 participants were located *within* the UK. Although it is possible that some of these contributors represented international investors, this finding reflects the relatively homogenous composition of land ownership in the Lancaster District, which is far less internationally linked than in metropolitan areas such as London or Manchester.

Most *professional, salaried* contributors often with responsibility or interest in several geographic areas were located outside of the district itself. As shown in Figure 14, clusters existed in Greater London and the North West region of the UK. For example, many 'space controllers', including consultants representing major landowners, were located in the large metropolitan areas of London, Manchester and Liverpool. Manchester was the base for many of the representatives with legal capacity such as regional

---

[78] De Lange et al. (2013) would refer to the overall contributor community as a 'networked public'.

headquarters of the national government, its affiliates (e.g. Natural England) and charities (e.g. English Heritage). London on the other hand was home to some of the representatives of large property developers, that held key development interests within the district. On average, non-local contributors made four comments each (two more than local contributors).

As may be expected, the majority of participants (72%) were located *within* the Lancaster district itself, including 295 local residents without stated organisational affiliation. Within the district, the analysis reflected a degree of regional specificity based on a number of local factors. Most obviously, clusters of local contributors broadly mirrored the different settlement densities. Clusters of activity were visible in the key urban settlements in the area, that included the City of Lancaster, Morecambe, and the towns of Carnforth and Silverdale. The analysis confirmed variation in the *level of participation* by the local communities, that confirmed variations that were also reported in interviews with the municipal planners.

As shown in Figure 14, citizens in the villages of Carnforth and the more affluent Silverdale were especially vocal. While the population of these small towns totals 7441[79], here 109 citizens contributed a total of 182 comments in response to a few sites suggested in the vicinity. Another hotspot for contributors was the city of Lancaster where most of the larger development sites were located. The city of Lancaster as the largest urban settlement in the area with 48085 residents received a comparatively smaller number - 105 citizens commenting 290 times. Morecambe, the second largest urban settlement with 33432 residents, on the other hand, saw four citizens contribute a total of 324 comments (most of them by one individual). As well as consistently high levels of privation in Morecambe, a separate action plan was being developed at the time of this study, which could explain the low number of participants from this area.

5.5.2 Contributors' relationship to various sites[80]

Local residents were by far the largest group amongst all participants. It may therefore be estimated that they usually represented at least half the contributions on particular sites. There was a range of reasons for contributions on specific sites, local expertise often being one of them. Consequently, location of local citizens and the places mentioned in their contributions were linked (Table 7). On average, local citizens were 1.9

[79] UK Census 2011

[80] For the perspective of urban computing, these 'sites' emerged as matters of concern around which various networked public(s) formed.

kilometres away from their indicated location and an even shorter distance for those without organisation affiliation, demonstrating their embeddedness within the local context and the likelihood of them having an insight into the use of the various sites.

In contrast, the average distance of non-Lancaster citizens to the sites was about 107 km. Of those, representatives of government organisations such as the regional county council were most proximate. Lancaster's status as the most economically active and largest district within the county is documented by the tight political links within the data. Many remote participants were affiliated to various organisations and they tended to provide substantive critique and more suggestions about the planning documents than local contributors[81].

	Lancaster	Non-Lancaster
(No affiliation)	1.2	115.3
Government	2.1	64.8
Businesses focused on development	2.8	107.1
Other businesses	0.7	180
Special interest	2.7	69.8
	1.9	**107.4**

Table 7: Average distance between citizen and sites per group (in km)

5.5.3 Distribution of comments across sites

In terms of the spread of mentions across the 178 sites, a few sites emerged as particularly controversial during the process. These 'top-10' sites attracted three-quarters of all comments. Given the topographic fragmentation and demographic diversity of the district as a whole, the popularity of each site varied depending on the type of allocation (commercial or residential), size of allocation, and its location within or outside the main urban core. As shown in Figure 15, larger sites for residential use, particularly those close to existing settlements, attracted a broad range of participants both from within and outside Lancaster and thus were more likely to become matters of shared concerns for various members of society. Larger sites were more likely to be found close to the large urban settlements (like Lancaster). In contrast, popular sites in smaller areas (sites 4,5,6,7,8, and 10 in Figure 15) tended to be much smaller, nevertheless attracted many contributions, but with a greater share of local contributors, possibly indicating the stronger role of local activism by the communities there.

[81] APPENDIX IV provides an analysis of the content of the contributor groups' comments. It has been left out of this chapter because such linguistic analysis was beyond the scope of our research question.

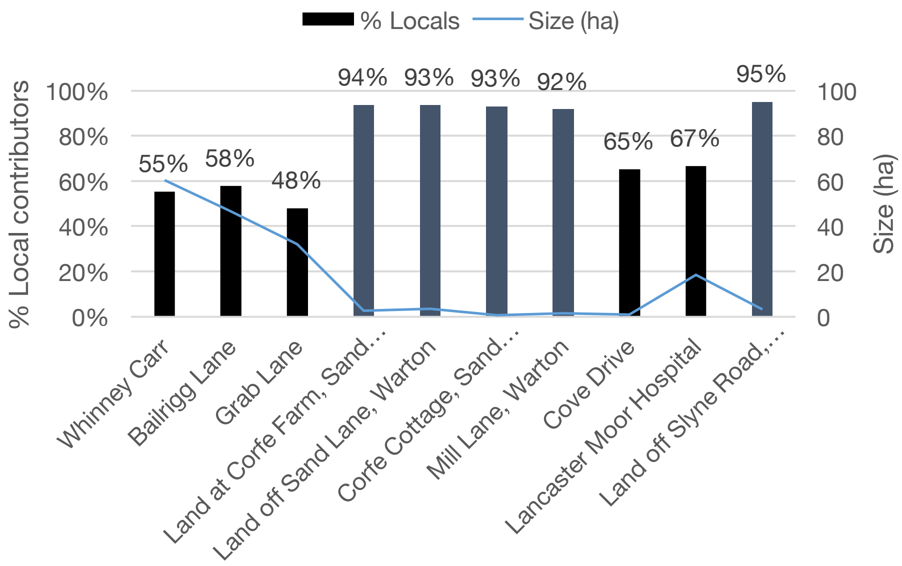


Figure 15: Top-10 commented sites, their sizes, and relative share of location contributions made on these sites. Sites located in rural parts of the study area are indicated in dark blue. As can be seen, those sites almost exclusively received comments from local residents.

In our analysis of contributions made per site, we found a number of clusters of several sites that were near to each other and attracted a large number of contributions. In the following, we highlight three of these clusters (also see Figure 16) and associate a quote from a contributor where available.

Cluster 1 (see Figure 16): In both consultation stages, large grassy farmland sites connecting the local university with the southern end of the city of Lancaster were by far the most controversial sites. In combination, these large areas were mentioned 107 times within the comments by an unusually diverse crowd. In comparison with other sites, this cluster of sites was popular among non-local contributors too. It suggested strong interest in these places and the increased potential for gains or losses across different group interests in the allocation, which could cause the loss of wildlife and open areas, and further exacerbate traffic congestion in this area. Commenting on this area, one planner said “the greenfield release for housing is something people in that very localised area have a lot of views about, but you are allocating this site for the district. So all you're getting is one side of the argument. The wider public,[…] it's very difficult to gauge their views on it.”

Cluster 2 (see Figure 16): A cluster of sites in a small town in the rural part of the district caused a negative response and strong local activism from many of the local residents. Sites in the area were mentioned 172 times in total in the online consultation by citizens, 93% of them were living in close vicinity. Here several sites were proposed initially in the first online consultation on fields behind existing residential property. The proposal caused upset in a large number of the local residents. When these sites were dropped in the second consultation stage, the activity of local residents and thus interest in the official participation process faded in turn.

Cluster 3 (see Figure 16): The strongest coupling between the location of sites and the location of associated contributors we observed in a village to the far North of the district. Local activism in the village was led by a local "resistance group" that actively campaigned against too many site allocations in the village. Commenting on the controversies, one interviewee told us: "There was a slight difficulty around a site that was added in Silverdale [...]. So there was an additional site [...] potentially put forward for housing developments, which came in as a last minute as I recall it, and we had a lot of adverse comments. The developer then sort of said 'well, actually it wasn't the whole of the site. It was only a small part of it that he was interested in' and so there was a particular confusion around that [...]. That caused a little bit of consternation and concern above and beyond what perhaps was warranted at the time, but that's been dealt with."

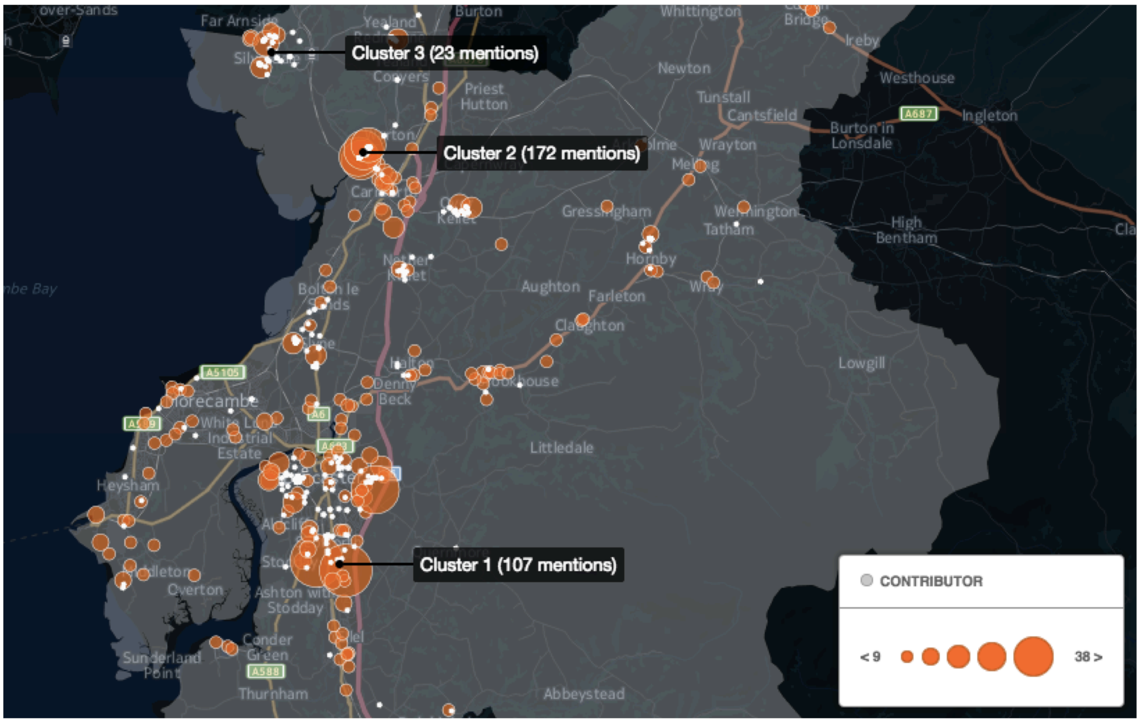


Figure 16: Comments per allocated site (indicated by size of circles)

5.5.4 Activism and self-organisation

In terms of the distribution of ownership and influence over the process across the various locations and associated communities, a difficulty for planners was the collaboration with the lower level political organisations. Those included the thirty-six parish councils which played an important part in determining the allocation of land in rural villages. Occasionally, the decisions of planners at the municipal administration level were perceived as outside influence, as one interviewee reported, "If you live in a rural area and you look at the planning authority, most rural communities see the planning authority as wanting to impose unwanted development.” This built up barriers in collaboration and coordination of allocation of sites for the district as a whole.

Commenting patterns indicated different degrees of local activism. This was pronounced in settlements across the eastern and northern rural fringes of the district where there were several similar place-specific networks in which local residents mostly mentioned sites in their vicinity. For example, residents of the affluent town of Silverdale comments were exclusively about sites there. Collaboration amongst residents in this town was evidenced by a large number of citizens using exactly the same comment. The citizens in Warton (cluster 2 in Figure 16) on the other hand, who tried to deter much additional future development in their area, coordination with each other was revealed by the fact that nearly every household that commented were properties that shared boundaries with the allocated sites.

The picture is more complicated for the residents within the city of Lancaster. While many citizens commented on the large greenfield sites (cluster 1 in Figure 16), their comments failed to indicate a similar degree of local attachment compared to residents in Warton (cluster 2). Comments covered a wide range of issues in relation to these sites including traffic congestion, the loss of valuable green space, and the impact on the character of the local environment. Sites in Lancaster received greater attention from contributors from outside Lancaster, developers and other organisational contributors alike.

Some notable exceptions existed. For example, one single local resident contributed to 90 different sites within the district making him by far the most devoted participant. While we have not had the opportunity to speak to him directly, his comments in terms of their content as well as the spread across various sites around the district (his average distance from sites was 5.2km and thereby much further than the average for local residents), we have reason to believe that he has a professional background in planning and interest in the area.

5.5.5 Impact of place owners’ and space controllers' contributions

Since the planners at the local municipal administration are legally obliged to respond to each comment in writing, consultation outcome documents contained indication of the necessary actions resulting from the concerns voiced within a comment. We used this to derive an analysis on the *impact* of individual comments. To do this, we counted an *impactful* comment as those for which planners indicated a follow-up action. Thus, we counted the comments that resulted in "change considered" and "required" responses by planners as "impactful comments" and determined the share of impactful comments of the total count of comments per contributor group as an indication of influence and thus power. The outcome of this analysis has been summarised in Figure 17.

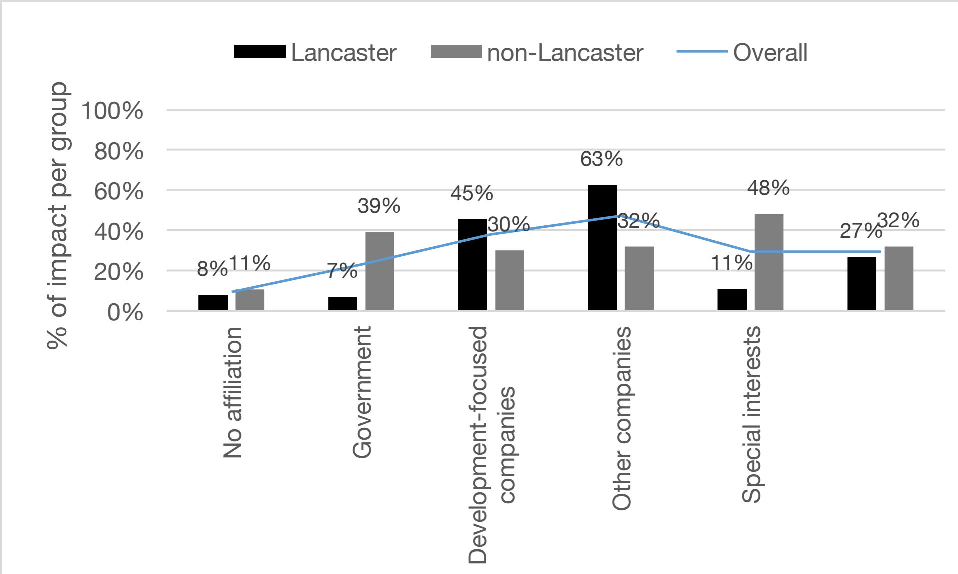


Figure 17: Statistics of the impact of comments per group

The statistics indicate that comments by local residents without organisational affiliation ("place owners") are acknowledged but rarely cause a follow-up action. On average, 8% of these comments resulted in an indicated follow-up action, a statistic that hints at the low impact that residents' comments have on the planners' response. In comparison, the comments that came from representatives with organisational affiliation had a higher rate of influencing planners' actions. We noted that Lancaster-based organisational contributors had a higher chance of exerting influence than non-Lancaster-based organisational contributors. For example, Lancaster-based developer companies' comments led to follow-up actions in 45% of cases whereas that was case for only 30% of cases from non-Lancaster based developers. On the other hand, local community groups (special interest) had a similarly lower chance to apply influence (11%) compared to national charities (48%).

This article does not provide conclusive evidence for the low success of local contributors to exercise influence. Based on what we have gathered from conversations with planners, possible factors may be duplication in local residents' concerns related to specific sites. It was said that while sites may be controversial as an allocation, the range of objections mentioned from local contributors fell into similar categories. Furthermore, some local contributors used an informal tone of voice, mentioned house value issues or underdeveloped comments that were crowded out by the more elaborate arguments of organised stakeholders. In interviews, the planners had pointed out that local comments were often "shallow" as they failed to engage with the established body of evidence that planners had collected or refused further house building outright.

5.6 Discussion of the findings

The prime objective of this study was to analyse the role of physical space for participation in spatial planning. In our geographically-integrated analysis (Goodchild et al. 2000), we documented the power imbalances by locality across different citizen groups, in which remote participants exerted a considerable influence over the geographical *space* Lancaster represents. In the following, we first revisit the patterns of participation we observed by local groups. Second, we discuss the findings in light of the trend towards 'devolution' in the UK. Third, we return to the discussion of the technology-mediated experience of place presented in related works and link this with the data we analysed through the view of 'transduction' (Galloway 2004).

5.6.1 Patterns of participation of local groups

For local contributors, our analysis highlighted that proximity to sites was an important factor for motivating their voluntary participation as these sites represented parts of space that they personally knew[82]. Cases of local citizen activism were pronounced in the rural parts of the study area, particularly the larger villages in the South, which provided a familiar point of reference for local contributors. For them, the location and the meaning associated with these villages or towns emerges as matters of concern for local contributors and therefore as a source of mutual understanding.

On the base line, our data indicates that citizens understand what *development allocations* imply for their places of concern and, thus, a substantial number participate (here: 295 local residents). Knowing that less than 1% of Lancaster's population contributed comments to the online consultation, our data indicates a range of participation styles linking local contributors with sites of interest. Often local residents' participation consisted of one-off comments, many including objections[83] to the allocation of a place for development. Some cases were exceptional. For example, one local contributor commented on a wide range of places all across the district so he may be

---

[82] This conclusion was derived after studying the content of comments across different participant groups, see APPENDIX IV.

[83] Such a phenomenon is usually referred to as "Not in my backyard" (NIMBYism)

considered a ‘civic entrepreneur’ as a special kind of local activist who cares for places beyond his immediate surrounding and affords the time to contribute to them.

Furthermore, regional differences in participation intensity were pronounced in our dataset. Several towns were in conflict with the planners’ decisions as they sought to fend off further development in their particular place. The pre-existing links of current and past residents who inhabited particular places may reinforce these distinctive socio-cultural geographies (Dourish and Bell 2007). Thus, as we zoomed in on the Lancaster district, having various sites with their diversity in associated contributors, the district’s resident population appears far from homogenous as it demonstrates conflict and competing interests from within. Although the average site allocated in the semi-rural parts of the district was much smaller than in the urban core, the sites still raised considerable attention locally, often with a much higher share of local contributors than remote contributors. Consequently, in allocating 5000 houses across different ‘patches’ across the district, planners faced the challenge of understanding, judging, coordinating, and mediating the competing expectations of each individual town and then across the whole Lancaster District.

Overall, given their professional associations, it is not incorrect to conclude that the majority of remote participants contributed either because they were remunerated to do so (and, at times, were obliged as part of their social or government mission) or hoped to receive or protect a future financial reward. Given their successful influence over the outcomes of the planning process through financial investing in property or as part of their organisation’s mission, those from remote locations serve as what might be called *space controllers.* An interesting picture is offered from within the district where in turn the majority were non-organisationally-affiliated contributors with a very low share of impact, who appear to be the *users* of various places within the Lancaster district. It is interesting to observe that there were a limited number of organisationally-affiliated local contributors with a higher share of impact than their remote peers. This suggests that possibly the combination of local knowledge and professional expertise makes those especially successful.

5.6.2 Implications for the trend towards localisation

In the UK, our analysis is positioned within the wider trend towards local autonomy that has been driven by the new technological opportunities that Internet-mediated communication provides and the institutional reforms of recent years. The latter is expressed in regulations on "neighbourhood planning", giving local communities, such as village administrations, the opportunity to develop their own planning documents (Parker et al. 2014). Given this context, our analysis confirmed geographical patterns in local participation, particularly in relation to sites in rural areas, that are indicative of local self-organisation. We may argue that drawing out spaces shared by different place owners in innovative ways may support local activism in spatial planning.

So far, planning has great similarities to ‘crowdsourcing’ in which planners retain ownership and control over the comments contributed to the planning process (Seltzer and Mahmoudi 2013). Participation in planning needs to overcome its confinement to governments’ terms and conditions (Boonstra and Boelens 2011). The existence of these participation clusters and the high share of local contributors to the ‘top-10’ sites indicate a form of local organisation that could possibly be better facilitated in revised planning processes. At this level, planners often speak to informally organised interest groups, such as charities and neighbourhood interest groups, but also to a range of formally organised groups, including parish councils.

One implication of the analysis for planners may be to start considering contributions received from these groups as a cluster of place owners. They will have the task of drawing on these flexible social structures or ‘new institutions’ at the town or village level to help gather ‘evidence’ but also to implement policies in a much closer fashion than practices in the current planning systems. Given the development on location-based services (Goodchild 2007) mentioned in the related works section, such revised patterns of interaction are possible in the future.

5.6.3 Implications for transduction

In urban planning, academics and practitioners have rarely considered the physical space with regard to participation in official online consultations (Royal Town Planning Institute 2014; Healey 1999). As one of the planners stated at the outset of the findings section, they had not analysed the geographical attributes of the participating citizens and the influence that their geographic context had on their contribution. Here we have shown that the data from mundane online consultations shows interesting practices of participants in and with *space* and serves as a suitable complement to the studies that analysed such relations on the basis of social media and other data. To some extent, this shows the *transduction* of practices involved in technical systems where there is no clear ‘old’ or ‘new’ form of participation (Galloway 2004).

Through the site allocations document, citizens, planners, and politicians can participate in the re-allocation of land as a limited physical resource within the Lancaster district. The actual object of interest is not the lengthy spatial plan[84], but rather the places mentioned in the document and consequentially the discussion that citizen participants have in relation to these places. We believe that this is what we should focus on, the practices in relation to the material and spatial contexts and their virtual representation to draw out the idea that planning as a process has to be *owned* by the various individuals within the Lancaster district in order to serve as catalyst for local development. In the transduction of space and techniques of participation in planning, enhancing participation in broad-area municipal planning should thus focus on re-emphasising the “different readings of space” (Dourish and Bell 2007).

In our analysis, articulating the physical space in public participation helped us to gain a sense of awareness of the contributor communities and it remains to be proven whether this may similarly facilitate a sense of community amongst contributors. A revised planning process that does not only draw on these geographical relationships, but potentially even diverts more process authority to the ‘owners’ of local places, may present itself as a classic (re)organisation dilemma in which planners at the established institution would give up certain responsibilities and control while gaining others. After all, somebody has to keep control of all site allocations. The devolution of authority could create additional incentives for increased local autonomy (through institutional arrangements). Equally, it would require appropriate technical support infrastructures that handle decentralised decision making, and it would require a revised role for planners to emerge more than before as mediators for setting the *ground rules* for site allocations within which place owners in collaboration with space controllers can derive suitable local choices.

5.7 Conclusion

Studies involving geospatial platforms and more so social media sites inspire serious questioning as to what new forms of participation may revolutionise planning itself. Could planning processes be more like a peer-production in which greater influence on *process* is given to local contributors rather than to planners themselves? We argued that in considering any technical intervention, it is important to consider the existing patterns of participation in spatial planning today. Hence we reviewed instances of participation through a geospatial lens that broadly considered the patterns of interaction within participation for planning itself. We reported on the patterns of participation in

[84] More than 50 pages are not uncommon

urban planning as evident from several stages of formal consultation for the development of a spatial plan.

The analysis focused on the physical context that was evident in the data. While such geospatial analysis become increasingly popular in relation to understanding participation on location-based services, such analysis was rarely undertaken for formal participation in spatial planning and therefore provides new insight into the patterns of participation evident in such formal processes. The present study alludes to more such spatially integrated information systems studies, which consider physical space as an important backdrop for participation.

The discipline of planning is slow to change. In our case study, we noticed that the various software tools through which municipal planners organised planning do not correspond to the more spatially integrated platforms online, such as Google Maps, Foursquare, Yelp and others. Given the emergence of such novel platforms that have the propensity for serving as vehicles for greater consideration of physical space in citizen participation matters, established engagement practices of planners are now challenged from outside the planning discipline and the call for institutional reform to attempt more local autonomy.

5.7.1 Limitations and future work

Our article calls for further future work. There is scope to refine the existing methodology and scale it. For example, the classification of participants in this study introduces a number of limitations. It could not account for changes in participants' organisational affiliation or location over the two-year time frame. This classification issue became evident in interviews with a select number of participants (see CHAPTER 6). For example, one participant took up and resigned from a role in local politics, one participant changed his job, another participant lost interest and discontinued her participation. Future study could develop temporally-sensitive categories to reflect such changes in participants' life.

Furthermore, geo-references for participants may contain inaccuracies as we could not verify the accuracy of individual post code data. Unlike studies of location-based services (see Bohøj et al. 2011), our study did not contain real-time geo-referenced data. Instead the data represented participation that took place 'ex-situ', either at a local consultation event or on the participant’s computer, not within the city. Future studies should consider data from location-based services for planning.

Finally, and possibly most importantly, our study only considered patterns of participation in relation to municipal planning for the Lancaster district. Future studies should consider patterns of participation on a larger scale, for example by an extension of the analysis approach across multiple administrative areas, or in metropolitan areas. This would be interesting since many organisational representatives ('space controllers') have interests in, and contribute to, consultations in different localities in parallel. Such an analysis would contribute towards the understanding of patterns of interaction in urban development across regional and possibly even national boundaries. Alternatively, future studies could focus intensively on the communication between municipal planners and place-focused activist grouping.

TRANSITION

Having established an overview of the patterns of participation as being evident in the archival data of the municipal planners, the next article provides additional detail on the institutional processes. It does so by analysing the institutional set-up participation opportunities in the planning process and the ICT facilities, that made up the publicly accessible information space. In the search for considerations for new forms of participation in planning, this article points to a number of dilemmas that planners face in establishing an information infrastructure amenable to collective action. The article considers the practices of accessing a case of plan development and the governance of the participatory activities and the ICTs that support the process. It is found that multiple dilemmas need to be confronted when considering institutional and technical set-ups designed for collective action.

A dilemma mentioned in the article, and one that should be emphasised here, is that of the challenge to sustain *momentum* in the planning process. Planners reported that momentum is required to ensure that plans move fast enough to pre-empt any changes in national policy (amending the requirements required for outcomes) or changes in the economic or socio-political context. For example, a downturn in the economy as well as a changing local government may require planners to redo some work already invested on preparing a planning document and thereby also redo the public participant events needed to conform to engagement requirements set out in law and expected by those who like to have an influence on the direction and content of the plans produced. Workshops undertaken at the early engagement stages ties up substantial staff resources but offer opportunities for an open-ended approach towards the various matters of concern. On the other hand, online comments on documents prepared by planners require less resourcing, but restrict what may be valued as suitable input. Therefore, the need for momentum performs as a constraint on the frequency, length, and type of participation opportunities planners may be willing to organise; and it is thus entangled in apparently competing demands as to how 'open' or 'closed' opportunities for participation should be.

Through an in-depth qualitative analysis of the practices of municipal planners in establishing an information infrastructure enabling participatory events to occur and the practices of a range of stakeholders as they were participating in campaigns arranged by planners, the article demonstrates the practices of 'infrastructuring' available information communication technologies (ICTs) so that participants are made aware of participation opportunities, partake according to their capabilities, and find outcomes resulting from these opportunities. Read in conjunction with the spatial analysis of patterns of participation (as provided in the previous chapter), the article develops further details on varying practices and capabilities put in place by various actors as they aim to influence the content of the plan documents. We see that local participants are more likely to rely on word-of-mouth and being 'within' their material context that the planning documents seek to affect, whereas remote participants used powerful means to recreate a sense of the material contexts through the use of specialist tools, such as geographic information systems.

In this, the study draws attention to the material and social contexts of infrastructure practices and the technical artefacts employed. For example, Suchman's (2005) argument of social affiliation and dissociation with technical objects is relevant here. The study demonstrates how planners, expert users of these systems, software and hardware associated with these complex objects affiliate themselves with these objects actively partaking in their reconfiguration given varying requirements along the planning process. Various mechanisms of formal boundaries for planners and their technologies, for example through contractual obligation with software suppliers, but also their own formalised procedural practices and inertia for change, imply a strong affiliation with their technical objects. On the other hand, various non-expert users of these objects said that infrastructure systems dissociated themselves with these technical objects. In my study this was due to a usability issue similar to those documented by Suchman (2005). There was evidence that dissociation of local participants with the objects used for online participation had an influence on the planners' choices to undertake a similar disassociation - ultimately dropping a software product. The cases indicates that the institutionally defined 'object' for negotiation of infrastructure capacities and engagement practices, the Statement of Community Involvement, was inefficient as an object for affiliation. Planners saw it as a waste of time and citizens failed to notice it as an object for providing feedback.

CHAPTER 6

Organising information systems for collective action — the case of developing urban plans

6.1 Abstract

While there appears to be a clear opportunity for enabling increased participation in public decision-making through information communication technologies, the achievement of any new forms of participation is confronted by the inertia of the existing technical and institutional context. Drawing upon an institutional theoretical approach using Hess & Ostrom's institutional analysis and development framework, we present an embedded retrospective case study of citizen participation across four participation stages for two municipal planning documents in Lancaster (UK). The dataset consisted of twenty-one participants covering organisers and citizen contributors as well as archival data from planners' databases. The analysis shows the dilemmas involved in the organisation of an information system for collective action such as the inevitable closure of open-ended participation, catering for diverse participation practices of geographically dispersed citizens, and the adaptation of matching technical infrastructures that support participation. Inequalities in participation and influence across a selection of seven situated and non-situated study participants illustrate the challenges of realising open and equal access to urban choices across citizens, and the dilemmas that confront public planners to level participation inequalities.

Author Keywords: urban planning, complex societal problems, IAD framework, extended design view, collective action, IT governance, information infrastructures

6.2 Introduction

As an established institutional process, urban planning involves the accumulation and synthesis of a large body of facts about the world. For the development of urban planning documents ("plans"), it is matched by a sustained dialogue amongst a diverse crowd of individuals, moderated by planners as key actors (F. Fischer 2000). As a result, plans[85] incorporate a complex network of issues that link various individuals with multiple agendas, interests, knowledges, and resources to places within a geographic area. Online-

[85] Here, plans are seen as information artefacts summarising collective outcomes.

accessible ICT facilities[86] have become indispensable to supplement interactions between those individuals, to facilitate 'access' to urban planning processes to society at large, beyond the locality in question.

We conducted an embedded in-depth case study to analyse the social (institutional) as well as technical constraints which affected access to, and influence over, the digital artefacts and ICT facilities used for participation. We asked (1) How were institutional and technical arrangements developed that enabled or constrained citizens' participation activities towards developing a local plan? (2) How did participants partake in the development of a local plan? To understand ICTs' infrastructural capacity, we stepped beyond isolated software implementations, localities and times, towards the consideration of multiple social settings, sites, and technologies across time ("extended design view") (Monteiro et al. 2012). We considered the heterogeneous information space as a product of a 'non-traditional information system'[87] (linked to the infrastructure view of ICT in the literature).

Our article is structured in three main parts. First we provide a literature review on information infrastructures and the opportunity to view planning as a non-traditional information system. We introduce the IAD framework for use in the analysis of information systems (Hess and Ostrom 2006a) and analyse the constraints to participation by applying the IAD retrospectively to the case. Lastly we consider the practices of a subset of participants embedded within the case. We discuss the implications of varying levels of access and influence of participants on considerations for the design of public information systems that enhance collective action.

6.3 Contextual review

The past five years have seen a proliferation in widespread use of social media and Internet-connected mobile devices amongst consumers. It has been said that the ubiquity of mobile phones with advanced sensing and localisation capabilities, for example, makes new forms of collective action possible (Burke et al. 2006; Cuff et al. 2008). Their preliminary use in planning shows new forms of micro (e.g. "specific, limited, and

---

[86] Online-accessible systems for citizen participation are useful for accumulating, categorising, and organising individuals' contributions as part of on-going dialogue (compare Saad-Sulonen 2012; Bohøj et al. 2011; Kingston 2002). They could offer new forms of participation that increase access to political choice and thus may support self-organisation.

[87] Later described as context with a multitude of actors with different interests, as well as a large number of different information technologies, linked together to achieve a common goal.

minimal") and "in-situ" participation (Nuojua 2010; Bohøj et al. 2011). Particularly in densely populated areas, such as cities, digital systems make up a significant part of the underlying technical infrastructure (S. Graham and Marvin 2001). In this context, one societal challenge rests in the design of digital infrastructures that enable interactions across users towards the development of shared outputs or 'collective artefacts'[88] while mediating and possibly changing existing power relations. The problem is related to the access to information (see CHAPTER 3).

Increasingly, information systems (IS) researchers are turning their focus beyond isolated ICT implementation in a single organisation towards ecosystems of ICTs, information infrastructures, with varying levels of accessibility by different actors (Monteiro et al. 2012; Rolland et al. 2006). Monteiro et al. (2012) highlight different characteristics of what they call information infrastructures in that they are open to an undefined number and type of users, serve as a connection between various different agendas of these users, and have evolutionary characteristics in that the infrastructure exhibits a 'generative' character influenced by past decisions which materialises in the present 'status quo'. Early on, it was observed that the role of institutions in infrastructures requires greater consideration (Hanseth et al. 1996).

Star et al. (1999, p. 382) advised that researchers should approach the study of infrastructures by visiting the sites where the 'dirty' work of infrastructuring is done. Examining infrastructures in field work becomes a combination of "historical and literary analysis, traditional tools like interviews and observations, system analysis, and usability studies". For informing interventions, Baker et al. (2007) recommended studying the flow of information amongst different individuals and group actors by achieving "a process-oriented approach" that captures the social nature of information processing and (re-)configuring of the technical infrastructure.

6.3.1 Plan development as non-traditional information system

Today, participation in planning relies on a mixture of online facilities for document access for time-restricted public consultations, described as "revise and comment" participation (Innes and Booher 2004). In this mode, document drafts are published online

[88] Garud et al. (2008) refer to the work by Simon (1996) who defined an artefact as a "meeting point" between an outer environment and an inner environment (that is a representation of the outside environment). We understand a collective artefact as a sophisticated interface, sufficiently brittle and flexible to accommodate the contribution of individuals across various social and physical settings. In our study, plans were seen as a collective artefact.

to enable access to a large number of unspecified users (i.e. the public), allowing them to influence these drafts through comments. Innes et al. (2004) critiqued this mode of participation for its lack of support for collaboration and mutual understanding. Even in more participatory modes, the terms of participation remain on the terms set by the established political institutions (Boonstra and Boelens 2011). Participation in this way may appear similar to what Bannon et al. (1997) describe as “arm’s length work” in bureaucratic organisations that offer limited opportunities to discuss the underlying information (e.g. the online-accessible document).

In their participation, citizens are challenged to navigate complex sets of constraints, including practical constraints (such as time limits and submission requirements) and many difficult to understand high-level constraints. These may include configuration of political powers, and socio-economic as well as socio-demographic contexts, which collective action in planning is subject to. Factual information (the “evidence”) and professional terminologies pose additional barriers to lay-users (Innes and Booher 2010). In reverse, an exclusive process limits the important situated perspectives of these contributors (Innes and Booher 2004).

Dilemmas exist in improving access to developing documents and plans that may resolve existing institutional barriers to new forms of participation. A key dilemma is how to configure ICT facilities to sustain large-scale participation in planning as collective action and process of sharing of digital media (Saad-Sulonen 2012). With the increasing role of digital ICT for the provision of broader access, further study is required of processes of participation in urban planning encompassing the sharing of digital content and the configuration of the ICT facilities that enable access to and the production of this content (Saad-Sulonen 2012). It helps to see participation in planning through an expanded design view to critique established modes of participation and ICT employed for this purpose (compare Staffans and Horelli 2014).

6.3.2 Key actors and institutional hierarchies

Public planners, as expert users, are the formal guardians of the institutional planning process and mediate the arm’s-length interactions of those participating. Therefore, planners serve as “information brokers” (Forester 1989). They are responsible for collecting, organising, and studying information to “recommend action” (A. C. Quinn and Ramasubramanian 2007). On behalf of the public, they translate discussion outcomes into “professional talk” (Rotondo and Selicato 2012). Therefore planners can be described as being associated with the role of “core organisers”, that Crowston et al. (2011) observed in studies of open-source software development.

Amongst the facilitation of substantive debate, planners' responsibility is to level the playing field often from a central 'top-down' position. They attempt to do so by provision of a range of communication channels and participation opportunities analogous to Bannon et al.'s (2007) notion of "platform coordinators" to enable potentially every member of the public to participate should they wish to do so. Through the curation of the many information artefacts and the filtering of contributions, they counteract "pollution" by filtering and removing obscene content, and synthesising information on behalf of the public. Participation in planning should relate to the sharing of digital media and the organisation of the ICT facilities involved (Saad-Sulonen 2012).

A wide range of individuals and group actors is key in bringing a participatory process to life. Their participation equips plans with valuable 'local', situated, sometimes indigenous information (F. Fischer 2000). As Fischer (2000, p. 74) notes, "what we call knowledge in the social world is the outcome of a negotiation between those with more 'expert knowledge' and the actors in the everyday worlds". Novel forms of participation in planning may offer opportunities for the citizen to become a 'popular scientist'. Scholars have called for greater emphasis on local self-organisation. For example, Boonstra et al. (2011) defined it as the existence of multiple planning systems led by community groups.

Local and community-based organisations[89] act as intermediaries for their respective audiences, applying their own ICT facilities, and interface with the plan development process to have influence. By curating information, such intermediaries often serve as relevance filters for their respective target group, making judgements on the adequacy of information and disseminating information (Durrance et al. 2006). Such organisations were also seen as important in the implementation of government policy (Rideout et al. 2007). Durance et al. (2006) talked mainly about civic organisations, but other actors, including consultants and other representatives, came with different causes, thematic interests, economic motives and resources.

6.3.3 Towards a profound understanding of citizen participation

Urban planning is made up of large-scale information systems in the public domain, an ecology of participants that can be described as "non-traditional" - consisting of many, overlapping, and embedded information systems with uneven patterns of access, participation and inclusion, depending on who has the resources and means to produce and access these embedded systems. The following case study is situated at the intersection of all these individuals / group actors and the publicly maintained participation

[89] In our example, we include parish and town councils in this group.

activities and associated ICT facilities as it follows an "ecological" approach (Saad-Sulonen 2010a).

To understand the infrastructural capacity of multiple, often non-compatible ICT facilities involved we study patterns of participation through an "extended design view" that considers multiple information systems of planners and citizens together. We use the IAD[90] framework to analyse the institutional practices to organise participation (Hess and Ostrom 2006). An institutional view provides a theory of social dynamics (Healey 1999).

6.4 Methodology

To study different ICTs, actors, and information artefacts following our two research questions,[91] we provide an in-depth case study with embedded units of analysis (Yin 2008). We followed a contextualist approach consistent with the significant role of grounded in-depth case study work alongside theory development[92] (Mjøset 2009). The goal of this approach is to substantiate potential future interventions as part of an ethnography for design (Baskerville and Myers 2014). The analysis considered the plan development process by following its evolution retrospectively over three years (Langley 2009).

First we will introduce the IAD framework. Subsequent sections will focus on data sampling, interview methodology, and technicalities of the data analysis.

6.4.1 Institutional analysis framework

The IAD framework provides a robust and tested foundation for a structured exploration into the make-up of the common properties of information infrastructure and the rules which govern access to the shared information resources that depend on collective action. In the context of studying non-traditional information systems, the IAD

[90] With a history in analysing the governance of community-governed resource systems, the IAD is well positioned to contribute to the understanding of information systems in society with relevance to crowds of various users who, by interacting, often unknowingly are engaging in the production of collective outcomes.

[91] See introduction section: How did participants partake in the development of a local plan and how did they engage in information sharing for this purpose? How did the observed institutional and technical arrangements enable or constrain their participation in discussion and information sharing?

[92] The practical experiences of applying this case study method has been described elsewhere (CHAPTER 4).

framework (see Figure 18) has advantages as a 'road map' for information systems analysis and can be combined with other IS methodologies, such as Actor Network Theory, Activity Theory[93].

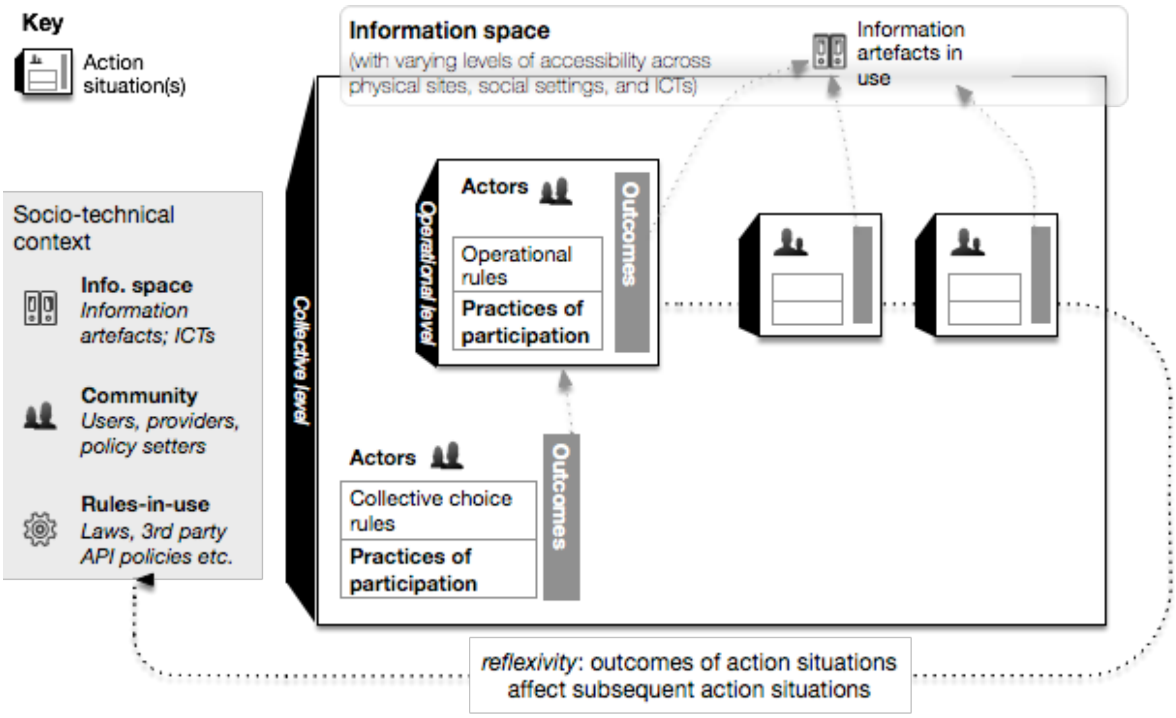


Figure 18: Adapted IAD framework for information systems analysis focusing on the development of the available information space (see CHAPTER 4)

By focusing on operational, collective, and constitutional rules-in-use, the IAD suggests three levels of analysis (Ostrom 2005). Determined at the collective choice level, operational rules affect outcomes on the ground and represent social agreements on the level of access given to different participants in influencing the plan documents. Beyond that, constitutional rules represent an even higher level of rule-making, which in this study is taken as context and included urban planning laws and policy. Having outlined these levels of the institution, the IAD then suggests separating out the overall process into distinguishable and somewhat complete action situations (e.g. a series of similar events or a single online consultation). The institutional set-up is probed by asking questions related to seven rule types that structured the particular action situation (Ostrom 2005). These will be introduced later in section 6.7.

The IAD is not a ready-made technique, but offers the flexibility to be adapted for a given study. As indicated in Figure 18, action arenas were sequentially linked on the

[93] A brief overview and comparison of these other frameworks is provided in the methodology chapter in section 4.3.2.

operational level[94] (here a refined version of plans as collective artefacts and subsequent series of consultation events). They can also be authoritatively linked if they influenced the rules at the operational level (e.g. agreeing on abolishing a key ICT facility) - considered here on the collective choice level. Focus of attention for the IAD adapted for information systems (Hess and Ostrom 2006) is on online-accessible information resources. In our study, this means the analysis of the configuration of and access to ICT facilities in planning given the institutional rules-in-use through a number of tracing techniques (CHAPTER 4).

6.4.2 Data sampling

The data for this study was obtained through a relationship with a local authority in the North West of the UK. In late 2012, the researchers approached the planning department for Lancaster District. In an exploratory phase, we co-developed a questionnaire with planners, which was distributed to 1000 members on the planners' official mailing list in early 2013. In parallel, we held five outreach events at local libraries in three towns within the district. This initial phase contributed to the building of links with the local public and planners. As a result, 130 citizens signed up to receive the questionnaire and overall we received 85 responses. Using the questionnaire, we gathered demographic details and assessed initial perceptions on recent participation in planning consultations.

We interviewed five municipal planners from the local authority who represented the core organisers in this process to determine the range of information-processing activities associated with different modes of participation events. Through their stories and a reconstruction of event chronologies, we traced the way in which their decisions affected the provision of opportunities for participation. The sample included a planner in the role of 'technical facilitator' who managed the ICT facilities, three case workers, who authored most of the two plan documents, and the head of the team (who kept an overview of the process).

In conjunction with archival records on 597 citizens provided by the planners, the questionnaire informed the main study phase by establishing demographic and participation details of a range of citizens. For sampling purposes, we grouped citizen contributors registered in the planners' archival data into ten categories using their primary location (e.g. situated within Lancaster District or not) and a contributor type judged by their organisational affiliation (individuals without organisational affiliation,

[94] Resulting in what was described as "culturally more advanced central activity" for sequential links and "rule-producing activities" respectively for authoritative links (compare Bertelsen and Bødker 2003).

special interest groups, business organisations with development interests, other businesses organisations and government actors (see CHAPTER 5). Using the survey responses linked with the planners' archival records, a set of study participants was sampled that covered all ten categories[95]. As non-local respondents were underrepresented in the questionnaire, individuals within underrepresented categories were approached. The final purposeful sample included 21 participants for interview (see section 6.6.3 for an overview of included interviewees).

6.4.3 Interviewing methodology

With each participant, interviews were conducted following a semi-structured approach supported by a thematic interview guide loosely based on IAD concepts, an event chronology of past on- and offline participatory activities ("timeline") reconstructed from public records and the questionnaire response[96]. We provided the chronology to all interview participants support recall of their past contributions. Beyond that, participants' retrospective narratives were corroborated by providing cues from known interaction within the public records[97]. These records listed past contributions to online consultations and attendances in face-to-face workshops and other meetings.

Each interview followed a three-phase interview design.

1. In the first phase, we discussed the participant's contextual environment including computing (and/or other specialist and organisational) resources they could access. We also established their relation to the planning process and their knowledge[98] of the Lancaster district. This interviewing phase was supported by participants' survey responses.
2. Then, the second phase traced the participant's retrospective narrative. For this, the aforementioned timeline and records of known interactions were valuable to remind participants of specific events in the past. The interview

[95] This can be considered as purposeful sample.

[96] Please note that no questionnaire responses were collected from the planners.

[97] For example, we might re-read a comment left at a previous online consultation and say when the comment was submitted and through which channel (email / online / letter). For some organisational participants, we might also refer to known actions of other participants from the same organisation to support recall.

[98] For remote participants, we asked whether they have ever visited the Lancaster district.

sought to ground the discussion of instances of participant-action-ICT interaction within these actual events.

3. Finally, we concluded the interviews with an all-round conclusion phase in which participants had the opportunity to comment on their interactions with the process as whole. This included their use of ICT facilities, assessment of outcomes of their interaction, and their role within[99] the process.

In total, 23 interviews were conducted[100] of 55 minutes average length. The shortest interview lasted 23 minutes while the longest one took 90 minutes.

6.4.4 Technical support tools

Secondary data included public records of event attendance and online commentary for 597 contributors across the four main engagement phases (June 2010 - October 2012). We used a relational database[101] to document all interactions with study participants and to synthesise the secondary and primary data on individual participants (Murmann 2010). This dataset enabled participant-comment network analysis as well as an interaction flow graph (see APPENDIX III). For analysis and interviews, to support recall and increase analytical accuracy, an interactive version of the reconstructed event chronology enabled us to move quickly between various parts of the process (Yin 2009). It enhanced the temporal dimension to this study.

6.4.5 Qualitative analysis of interviews

For interviews, we produced denaturalised transcriptions (Oliver et al. 2005), which we analysed with qualitative analysis software[102] using process, perceptual, and descriptive coding techniques (Miles et al. 2014). Process codes[103] included descriptions of participants' actions. A long list of actions was developed deductively based on participants' explanations. Perception codes related to evaluative questions, for example regarding perceived challenges to access in reference to participation events. Descriptive

---

[99] For example as information provider or information user.

[100] Some participants interviews were followed up a second time.

[101] FileMaker 12.

[102] Atlas.TI.

[103] A full list of the process codes is available in the code book attached as APPENDIX II.

codes included instances of events, individual/group actors, ICT facilities, and information artefacts mentioned. In a second analytical step, we arranged codes into conceptual groups: the process codes were conceptualised inductively to be indicative of information processing steps mentioned by study participants. Descriptive codes came from the mark-up of instances of ICT facilities and events documented in archival data[104] as well as the rule concepts in the theoretical IAD framework.

For all study participants, we prepared interim case reports synthesising their answers to the questionnaire, archival data documenting their participation over time and their responses in interviews. For key study participants, we developed summarising activity theory diagrams (Bertelsen and Bødker 2003) in the relational database by synthesising participants' questionnaire responses, related archival records and statements in interviews. To make sense of participants' interactions we drew on the interaction flow chart as well as a participant-comment network representation (see APPENDIX III)

6.5 Outline for the case analysis

We present the plan development process as the overall unit of analysis in this case study. This unit of analysis was manifested in an earlier analysis of the spatial distribution of contributors to the process (see CHAPTER 5) and it follows Crowston's (2011) lens of circles of participation. To call attention to the social dilemmas encountered in this information system, especially related to inclusion / exclusion and access / non-access, we analysed the institutional and technical arrangements that enabled or inhibited participation.

An outline of the case analysis is provided in the Figure 19. First we describe the contextual characteristics of the information system (step 1). This was done by documenting the ICT facilities we encountered and the characteristics of the "communities" using them[105]. We applied Crowston's (2011) circles of participation to describe the dependencies and relative position of participants to the core organisers (the planners). Through a process narrative (step 2), we dealt with the operational rules

---

[104] Relevant archival data included documents that explained consultations and workshops before they took place, consultation / workshop outcome reports, and the Statement of Community Involvement (SCI).

[105] A geographic analysis of the patterns of interactions in this system was provided elsewhere (CHAPTER 5).

governing participation activities. In conjunction, we considered the collective choices that determined these operational rules. In a final step (step 3) we examined the participation practices of a subset of the study participants (excluding the municipal planners involved). To summarise the social and technical context that supported their interactions, we heuristically applied the activity theory framework (Bertelsen and Bødker 2003).

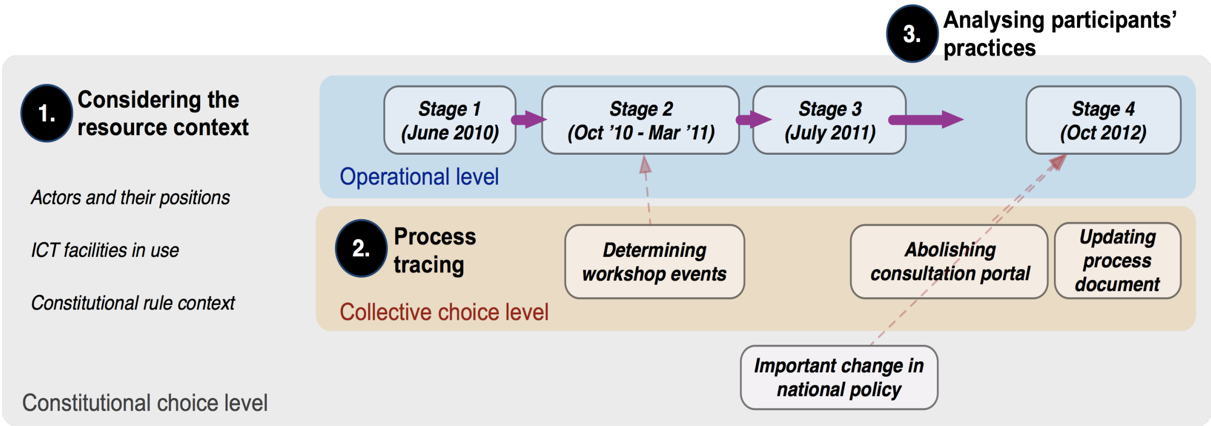


Figure 19: Outline of analytical approach

6.6 Case analysis

This case of plan development and associated information infrastructures was situated in a municipality in the UK. Following the analysis framework, we first positioned the case study in its local context analysing the relevant constitutional rules, the available ICT facilities that comprised the digital infrastructure and the positions of actors in their physical context.

6.6.1 Policy context — the constitutional rules

For this information system, legal frameworks provided a set of formal constitutional rules and objectives for public planners (Cullingworth and Nadin 2006). Through setting basic requirements for the plan development process and detailing of expected outcomes, laws gave rise to the social process considered within this case study and enabled us to state the broader social objectives. D. Rogers [development consultant] noted that the process is similar for all 336 local authorities in the UK, but local variations exist that allow municipal planners to adapt participatory activities to their locality, staffing capabilities and the ICT facilities available to them.

Laws require municipal planners to produce a project plan, known as the Local Development Scheme, to indicate a timeline in which the set of legally required planning documents will be produced. At the onset of this study in late 2012, a key planning document had already been adopted that described the district's development aspirations[106] outlining the general direction for future urban and village development in the case site. Now, two complementary planning documents needed to be produced: a spatial plan to identify land for residential, employment or future infrastructure developments; and a complementary document that outlines development management strategies and criteria that would be taken into account in evaluating future development proposals. Both are outcome artefacts.

In terms of participation guidelines, planners were required to publish a manual, known as Statement of Community Involvement (SCI), that explained to citizens how and when the planners intended to provide access to the process (Doak and Parker 2005). T. Rort [planner's team leader] thought that this requirement was rather a distraction and additional administrative burden. Since "nobody ever looks at (this document)", he found it far more appropriate to provide regular and relevant updates on the planners' websites instead, where citizens were more likely to see them. At the time of the study the government relaxed requirements so that the document could now be updated on an as-needed basis.

6.6.2 Physical context — the geographical setting

The geographical setting for this study is the Lancaster District (in the following referred to as "district"), an area in the North West of the UK, and its people. Lancaster City Council is the local "planning authority" for the district, which is a semi-rural area with both larger urban settlements and rural parts (Figure 20). As of 2011, it was home to 138,000 people (Office for National Statistics 2011). About 75% of the local residents lived in the two larger urban settlements, the city of Lancaster and the seaside town of Morecambe, with a number of smaller villages spread around the rural parts. In terms of digital access, 80% of the local households had broadband access with reduced access in rural areas. In 2013, smart phone adoption across all age bands was at 28% putting it below the UK national average[107].

---

[106] Known as Core Strategy document

[107] Based on data from 2012. See: The communications market report 2012 (Ofcom, 2012).

Figure 20: Important localities within the case study site

J. Finnan [manager of a local shopping centre] pointed to the diverse makeup of the area, saying that “the district is a difficult one for planners to actually pin down, [...] with a city centre, a seaside resort and a large rural hinterland, and two universities as well. I mean it is a real cocktail of interest there.” The seaside resort, the town of Morecambe, is economically impoverished, containing some of the most deprived areas in the UK.

Based in Morecambe (see Figure 17), the municipal planners had the difficult task of coordinating participatory activities across the spatial extent of the district. They therefore had to cater to an extremely diverse set of communities and their needs and aspirations. Detailed analysis of commenting patterns of 465 citizens, mirrored a substantial degree of citizen activism in smaller villages (see CHAPTER 5). Occasionally, and particularly for residents in towns and villages around the urban core, this was accompanied by distrust towards or misunderstanding of planners’ decisions.

According to the team leader,T. Rort, there was a vocal “green party contingent” and a “lot of academics” in parts of the district, who took “an interest in how their area is going to develop and they'll come and talk to you”. Participant records showed that events organised in the villages of Silverdale and Carnforth in the north of the district were attended more than in other localities. Inhabitants in deprived areas were especially hard to reach.

6.6.3 Social context — the actors and their positions

To place our study participants in relation with the planning process, we drew on the concept of circles of engagement (Crowston 2011). In the archival data, participation intensity varied dramatically broadly following a power law distribution. The circles of engagement provide a matching conceptualisation of the differences in participation intensity. For the arrangement, we drew on the knowledge of their past interactions, particularly the regularity in which they followed through across the whole length of the process even if they did not make formal contributions at each stage. For each circle, we deducted some indicative group size counts to achieve a size estimate of the respective circles as we go outwards from the core organisers (see Figure 21). Each are now explained.

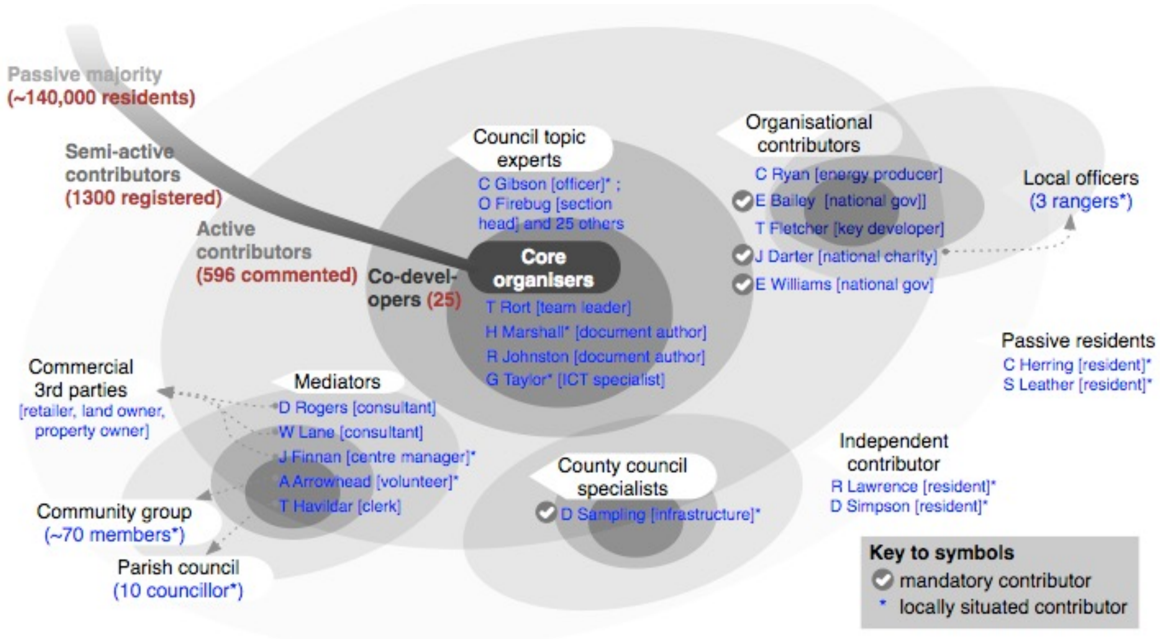


Figure 21: Mapping of study's participants (as seen from the vantage point of the planners as core organisers placed in the centre)

This positions the team of planners in the centre as core organisers and maps other research participants in several circles of participation around them on this canvas. For the core organisers, team size varied over the years, but remained mostly below ten individuals. The five key team members included two document authors, the head of the team, and an important process support worker (the technical facilitator). A wider circle of ~ twenty-five city council officers with whom they frequently and formally interacted, are described as co-developers. Some amongst them had direct authoring responsibility for sections of documents or would be end users of the final planning documents.

Active contributors include the 597 citizens, who attended meetings or commented formally, making some 2100 active formal instances of participation (see

CHAPTER 5). Some were known as “statutory consultees” so their pro-active involvement was required and the planners kept a list on who those were[108]. For example, coal mining in the area required involvement of the Coal Authority. According to interviewee, A, Arrowhead [local community group], “all of the statutory bodies [....], like the NHS [....], Natural England, the Environment Agency, United Utilities [...] have somebody who wades through these documents and responds on their behalf”. Such regular and professional actors were described as the established “planning policy community”, a diverse crowd of individuals with implicit understanding of planning[109].

Semi-active contributors are indicated as those citizens registered to receive regular updates. This includes active contributors. As of March 2014, the official contacts database contained 1,310 individuals of which 501 were members of the public and 809 a mix of organisations, businesses and other stakeholders. When the process began four years earlier, there were 900 fewer registered individuals. The growth in the registration count indicates growing interest in this process amongst members of the public. Unlike the circles beyond the semi-active contributors, registered citizens are known to planners and they can contact them directly by email. Registered participants may not always have a need to respond formally hence there may be no formal instance of participation from them.

Planning has an impact on citizens who may not actively participate in the formal process. In the long-run it will be the citizens within the Lancaster district who will be affected by changes in the built environment. We have indicated the total population of the district (138,000) as a proxy for a passive majority. If participation in this planning process is seen as process for collective action, it is this intricacy of participation that remains a central dilemma in planning (Innes and Booher 2004). This is a key point in our argument. Usually for the official, centrally organised participation process, Cullingworth et al. (2006, p. 432) observed that “it is only a minority who are prepared to do anything other than grumble”. Calls for self-organisation (Boonstra and Boelens 2011) highlight that there are many other processes that appreciate peripheral modes of participation by community groups.

[108] In the case of Lancaster, these are ~ 90 local and national organisations.

[109] Healey defined this community as a “network of relations and frames of reference that develop amongst those actors interlinked through regular relations around [...] particular sets of issues, from which a shared understanding of issues and debates evolves” (2006).

6.6.4 Technical context — the ICTs that comprised the digital infrastructure

In the IAD framework, 'facilities' are understood as elementary technical components for storing digital artefacts (such as citizens' comments, and planning documents) and making them available given a set of access constraints determined by the institution (Hess and Ostrom 2003).

For planners, a key organisational challenge was to offer an infrastructure for large-scale participation. Naturally there is a trade-off, as T. Rort [team leader] noted that "a big amount of time is spent on managing the process which may distract from the content". While in the past physical facilities such as libraries were used as primary means to provide public access to plan documents, digital online-accessible facilities have become an increasingly important part of the infrastructure for participation.

In our case, accessibility and manual integration of different ICTs became important concerns. In this process a diverse set of ICTs was employed in support of process management. Planners drew on a diverse set of non-compatible ICT facilities which served fairly different purposes in support of their work, broadly including practices of storing for long-term retrieval/archiving, sharing (internally and/or with the public) as well as receiving citizen feedback. We have listed eight important ICTs and their accessibility below (Table 8) differentiating between their purposes and their accessibility to external participants. We will now explain each in turn.

	ICT facilities in use	Storing / archiving	Sharing (internally)	Authoring plans	Sharing (externally)	Receiving
Online accessible	Online commenting facility ("Planning portal")	●		●	●	●
	WebMap (mapping platform)				●	
	Issue (web publishing platform)				●	
	Planners' webpages				●	
Not online accessible	Popular office software			●		
	Shared email inbox & archive	●				●
	Shared network drive	●	●			
	File archiving and management system	●	●			●

Table 8: Function and accessibility of ICT facilities employed in combination by the planners

6.6.4.1 Online accessible ICTs

The most important ICT facility for publishing documents and articulating planners' current activity and progress were the dedicated web pages on the local administration's website. Each of the ten planners in the team developed content that was then uploaded as updates by two planning assistants. For T. Rort [head of the planning team], the website was important in keeping an overview of the process as it was used "a bit like a library" on which documents, data, and project schedules were arranged and publicised.

For the past six years, the team of planners also operated a specialised online consultation portal used during public consultations hosted and supplied by a third party, similar to “review and comment” type interactions (Innes and Booher 2004). This planning portal was employed with the idea of having an electronic facility to serve documents and to enable commenting - it handled the consultations and helped in preparing and publishing document drafts drawn up by different team members. Throughout the six years, encouraged by T. Rort [head of the planning team], the tool was put to heavy use. Planners however noted that use of the portal by external contributors was consistently low. He estimated that 90% of comments came through via email or letter requiring additional work for planners in inputting the information manually into the consultation portal.

G. Taylor [process support] who looked after the ICT components, similar to a “platform coordinator” (Bannon and Bødker 1997) and technical facilitator, administered an online interactive map on which proposed sites’ policies would be marked up and hyperlinked to the planning portal. Planners saw mapping as being of key importance, but with constrained resources in expertise, only the legally required online “proposals map” was made available on an online geographic information system (GIS) throughout the process. While this ICT facility served information, it was unable to support receipt of information from external participants.

6.6.4.2 Non-online accessible ICTs

Additional ICT facilities were not directly accessible by external participants. Since most comments were received by email, a shared email inbox acquired importance as a secondary archive. G. Taylor [process support] noted that “all the emails that we received went to the (shared email address). We've got our own inbox for that and all the emails we received are all stored in there and so that's the kind of archiving system [...]”. No external participant had “editing permissions” for information artefacts (listed in the next section). Plan documents were authored via the planning portal facility and later through word processing software. For file sharing in the team, officers used an internal server drive. H. Marshall [document author] noted “the drive is what everyone can access. It's where everybody stores information [...]. All the minutes and everything would be on that [...] drive so everybody can access them [...]. It is where everything is stored basically in draft and also in final form”.

6.7 Views from the inside

In the following we outline how the information infrastructure made up of the ICT facilities and the associated information space made up of various information artefacts were organised by planners. This is used to introduce the process view on organising the technical infrastructure for participation activities.

Across the four stages, the public-accessible information space served via the ICT facilities mentioned in the previous section evolved continuously as planners produced a total of five interim plan drafts, nine outcome reports, and an archive of more than 200 additional documents of 'evidence' and process documentation. Additionally, 600 external contributors, including local residents and various organisational representatives, generated approximately 2,500 comments across four official consultations either through email, postal letter or the online planning portal that presents additional information within the information space. The Table 9 provides an overview of these information artefacts and their accessibility.

Information artefact type	Example	Author access
Interim versions of plan documents [collective artefacts]	Drafts of plan documents	Planners
Process documents	Consultation reports, process reflective logs, reports to internal review committee	Planners
Analysis of policy situation	Assessments and recommendations	Planners
Structured & curated information	Repository of available sites & site constraints	Planners
Sourced specialist reports and factual data ['evidence']	Paid-for studies & surveys	Paid contributor
Documented contributions (on documents)	Textual comments on plan documents	Contributors (including those paid for by third parties)

Table 9: Overview of the main types of information artefacts and their accessibility

Tracing the organisation of the information infrastructure from the core organisers outwards, it becomes apparent that the planners organised four distinct stages of participation activities. But while these activities represented an essential part of the (inter)actions that led to the final plan documents, we found many other aspects of the process that occurred with limited public accessibility, including the authoring of the intermediate drafts, and the production of methodically derived facts[110] (referred to as "evidence"). Each of these background activities posed constraints on the timing of public participation events.

Explaining these dynamics, the planning team leader said, a "huge number of evidence (has) to be gathered on a huge number of subjects [...] which at a point in time (needs to be) sufficient in its breadth, so it covers all the subjects, and (is) up-to-date [...].

[110] For example housing market demand and supply surveys, habitat assessments, population forecast calculations and other predictions.

We need to have *momentum in the system* for producing the plans because if we delay (it) then the evidence base becomes out of date". The number and forms of participation activities were constrained by availability of staff and funding. "It is time and people and resources. [...] If we had a team of 20 people we could do twice as many exhibitions". Given the constraints, planners unavoidably had to make judgements as to how to organise and time appropriate public access.

Legal requirements set the information rule that specified the publication of outcome report documents after each stage, which A. Arrowhead [local community group] described as "huge" PDF documents. In it, planners summarised all citizens' comments in long tables and stated whether a comment would result in a change to the documents. Author access to plans was constrained to planners, whereas citizens could submit written comments during any consultation or voice concerns in person at an information event. Only formal interactions were documented in outcome reports and delivered ex post without options for collaboration among citizens. The information space offered a complex web of dependencies across different social settings, sites, and ICT facilities.

The resulting decisions constraining participation are viewed in our study as the preliminary rules for collective action. Retrospectively, we now go through the four stages and highlight a number of interesting action situations that were of importance for these decisions that related the organisation of the process and its technical infrastructure ("collective choice level"). Drawing on the IAD framework, we summarised the important 'rules' that applied to participation activities across the four years (Table 10) and explained each stage in the subsequent four sections.

This set-up of rules is what Ostrom (2005) referred to as the operational level as it affects outcomes on the "ground", here the information space. Deducted from the analysis of actors involved, position rules identified the main contributor groups, which are here condensed to the binary of planners and contributors. The set of rules helps to describe how individuals took up these respective roles (boundary rule), what they could do in these roles (choice rules) and with which possible incentives (pay off). The rules for informing related to the feedback loops via the communication channels employed (such as the planners' mailing list). Aggregation rules described how interactions (such as participation instances) would be aggregated to intermediary outcomes, which mostly related to the production of plan documents[111], but also the decisions on changes to the technical infrastructure.

[111] Planners produced intermediate draft documents for stage three and four.

	[1] Combined Scoping (Jun 2010)	[2] Exploring Options (Oct 2010 - Mar 2011)	[3] Developing Options (Jul 2011)	[4] Preferred Options (Oct 2012)
Positions	[Planner] [internal officers] [Contributor]	[Planner] [Attendee] [Contributor]	[Planner] [Contributor]	[Planner] [Contributor]
Boundary	Planners (formal contract, member of policy team), internal officers (employed by council, invited by planners), Contributor (anybody w access to Document)	Same as before, but Attendees are selected by planners based on earlier contributors	Planners (formal contract, member of policy team), Contributor (anybody w access to Document)	Planners (formal contract, member of policy team), Contributor (anybody w access to Document)
Choice	Contributor can submit a comment [**6 weeks**], Planners analyse and store comments	Planners can decide on number and type of events held, attendees can deliberate face-to-face	Same as in [1] but **9 weeks**	Same as in [1] but **7 weeks**
Aggrega-tion	Planners develop key themes - "we drafted objectives and put them to internal officers"	Planners summed up the key issues (one planner per document)	One planner reviews comments. Difficult comments are discussed in the team	One planner reviews comments. Difficult comments are discussed in the team
Informa-tion	Letters/emails send to consultee database, "everything online", press releases	Select number of attendees are invited, outcome reports shared with all	Notification send to the consultee database, documents available via portal	Notifications send to the consultee database, documents available via portal and 3rd party online document publishing portal
Pay off	Participation enabled early influence and involvement at workshops	Early participation enables more "strategic influence". Direct face-to-face contact time.	Possibility of influence - vague. Professional commentators - financial reward.	Possibility of influence - vague. Professional commentators - financial reward.
Scope	"was really vague […] they could virtually put anything down"	No requirements for outcomes set	No requirements for outcomes set	No requirements for outcomes set

Table 10: Overview of operational rules for the main four stages in the process of developing two plan documents

6.7.1 First stage - "Combined scoping" (Jun 2010)

Sixty individuals submitted 269 comments on a 10-page document that was made available via the planner's online commenting facility. T. Rort [the head planner] pointed out that this consultation had no "remit", it was not legally required, and it was used as an opportunity for an informal beginning. For R. Johnston [local planner] the stage was "really vague [...]" and "(contributors) could virtually put anything down" as a suggestion. R. Johnston [document author and local planner] noted that comments were aggregated manually to "subject areas which interested people most and which got the most response" and used to determine a focus. In a closed October 2010 meeting, 25 officers were selected to attend a feedback session, and, as a result, planners agreed on five themes for thematic workshops at the next stage. Furthermore, for boundary setting, R. Tort [the head planner and team lead] noted how this stage "made us aware of people who had an interest" and indicated that "we quite cleverly used that stage to identify people who had opinions, thoughts, arguments, and we then used them very much in supporting the next stage" of workshops. In this sense the planners began to register previously anonymous contributors and forged links with community groups, businesses, and other key participants.

Collective choice action arena (determining workshop events): beyond setting a topical focus, determining structure of activities in this next stage, R. Johnston [document author] noted that "a lot of the early work in terms of what we did was thought up by myself and (H. Marshall [document author]). We did try to create innovative ways to engage people." In a seminar on consultation methods, planners learned about an outline for thematic workshops. While the set-up for spatial workshops[112] resulted from H. Marshall's [planner and document author] previous work experiences, he understood it to be a good exercise to demonstrate to members of the public how difficult it is to find suitable sites for development[113]. These two collective choices established the context for face-to-face workshops in the second stage by setting operational choices available to citizen contributors.

6.7.2 Second stage - "Exploring the options" (October 2010 - March 2011)

Eleven face-to-face workshops at the second stage were the most resource intensive participation activities. In total, planners involve about 150 individuals across 11 face-to-face sessions. They required significant manual documentation and processing of the session outcomes. As one planner noted, "the mechanics of collecting information were all done in a very informal way (through) facilitators and people who were transcribing". They "weren't asking them for representations or any kind of formal comment they have to take the time and effort to write down." In the process, only the content of the conversation was documented.

Due to staffing constraints, planners loosely applied a boundary rule for participation. Participants would qualify based on their participation at the previous stage as T. Rort [team lead] expressed with the intention of bringing "together people with opposing views to make them share each other's thoughts". The workshops were all held in the urban core, Lancaster, and predominantly attended by politically-active representatives from the district. Some off-site participants attended too, with the aim to meet planners in person, otherwise it was difficult for them to spare the time to travel. E. Williams [Coal Authority] noted that "as an organisation (we) don't attend [...] workshops, because you'll appreciate there are 180 coal field local authorities and [...] we basically haven't got enough people to send everywhere all the time. So we tend to just stick to the [...] published document stages, rather than the more interactive workshops [...]." For a local contributor, such as A. Arrowhead [local community group] on the other hand, "it gave us a positive feeling", the planners were "providing an outreach platform to bring in

---

112 Poker chips were used for participants to indicate land allocation preferences. This was previously described as a "Planning for Real" exercise (see Kingston 2002).

113 Part of the housing predictions required planners to find space for 5000 houses within a 10-year time frame.

different voices, [...] and ensure that they are fed into the development of these documents." This exemplifies different modes of participation.

Although unsupported by the planners' ICT facilities, the 'off-line' interactions and their associated information artefacts, mainly written notes and annotated maps, were an integral part of the process. Access to this raw material was restricted to attendees. However, as per legal requirement, planners produced outcome documents and subsequently shared those on the planners' website and with the 900 semi-active / active individuals and group actors, who were registered on the planner's database.

6.7.3 Third stage - "Developing the options" (Jul 2011)

Subsequent to the eleven workshops, planners H. Marshall and R. Johnston authored initial drafts of the two plan documents. In terms of the information space, there was now a clear shift to established, mediated participation modes, described as "review and comment interactions" (Innes and Booher 2004) as the process became more formalised. In preparation for the first online consultation, G. Taylor [process support] inserted web links to the planning portal within an emailed notice to citizens registered on the contact database. J. Finnan [local resident and manager of a local shopping centre] noted that the planners "had been pretty good at that". Local residents were sent a postcard and informed by a notice in a newspaper.

Such 'review & comment' interactions are a standard in the canon of participatory methods for established institutions (Innes and Booher 2004). In terms of the operational rules in use, consultations required contributors to publicly disclose personal details such as their real name, organisational affiliation, and address along with their comments on a particular position in the plan document which could correspond to a theme or a locality. Participation was constrained to a nine-week period within which 332 contributors made 1202 comments.

While letter and email contributions could be submitted without additional technical 'hurdles', the online commenting facility required participants to register for an account before they could comment (boundary rule) which presented a substantial barrier for on-and-off contributors. For example, one local resident publicly protested that "merely to comment has taken a long time and has involved engaging in a series of complex procedures to register, find the plans, work out how to comment (NO readily accessible button or similar link on the appropriate page where the plans are located) and so on." He speculated that "it is as if the people setting up this website did not want comments". But some frequent participants used to the site noted that "the use of a threaded comments website [...] is very VERY much appreciated as it allows an ongoing dialogue with people" to help long-term engagement. Research participants R. Arrowhead [local community group] and T. Fletcher [key developer] reported going through others' comments to understand complementary or conflicting points.

As technical mediator, the online commenting facility was indispensable in enabling citizens to comment and to review others' comments. While it faced the problem of the many diverse practices in access, for some it seemed to support a sense of collective awareness since all online submissions were immediately accessible and planners manually input additional submissions from emails and letters. However, this practice was poorly supported by the institutional practices. To illustrate this point, adding comments manually to the system took planners 15 weeks beyond the closure of the participation period at which point in time no additional contributions were possible.

Collective choice action arena: Determining changes to the technological infrastructure: The critical citizen feedback gave rise to a collective choice action situation that resulted in future changes to the technical infrastructure, indicative of how infrastructure choices were made. G. Taylor [process support and with responsibility for web pages and ICTs] noted, the planning team had reservations, too, since they found it difficult authoring plan documents on it. In a closed weekly meeting the planners "finally agreed that (the portal) was not an efficient way of producing documents". T. Rort [team lead] described how this decision came about: "We just talked it through [...] at team meetings [...]. I remember asking G. Taylor if she fancied approaching it (by) writing down all the things that (the online commenting facility) does and then think about, is this something that (it) does that we will miss when we no longer have (it). I think Grace's approach was quite different. Grace […] knew in her head what (the online commenting facility) does and she's working to replicate each of those processes through an alternative means [...] it's probably not perfect. There probably are / well, we are […] discovering things that once it is switched off, we will no longer have access to." No separate notices were sent to citizens about the impending shift. This change was a gradual change as the facility continued to be used in the final consultation stage, but was increasingly supplemented by additional internal effort to replicate its functionalities.

6.7.4 Final stage - "Preferred options" (Oct 2012)

There was then a year-long period of inactivity of public participation which planner R. Johnston described as a "grey area" as more detailed documents were drafted. J. Finnan [local shopping centre manager] speculated that "you get a collecting in of the information and then no activity for quite a period of time while it's compiled and produced into a report to go back out, don't you. So, that's probably what you are looking at in that period there". R. Johnston [author for the spatial document] described it as “quite a busy period even though [...] things weren't actually that out to the public. There was a lot of stuff going on in the background”.

For example, progress was slowed by changes to national planning priorities at the constitutional level, representing an external influence for participation activities to date. T. Rort [team lead] commented that: “we have our evidence, we have our process, and the context we are working in from the position of national guidance changes around us and quite often we need to take people with us on that journey.” The authoring of detailed versions of the two plan artefacts thus took nearly five month between January and May 2012 and required additional closed meetings with specialists and other council experts on specific subject matters.

When the final consultation could eventually take place in late 2012, T. Rort [team lead] even considered it the first “real” consultation as the document’s content was now close to its final form. For R. Johnston [author of the general policies document] it was “the detailed document going out for the first time and some of it was a shock to people. All the stuff in the past has always been very [...] light touch in terms of 'yea, you still got a chance to influence it' [...] This one, in particular with the land allocation site of things, we'd identified sites that we felt were suitable for development.” Given this big change in emphasis, choices for citizen contributors were now considerably constrained as the process drew to an end.

As consequence of the collective choice action situation described earlier, G. Taylor [process support] noted that the online commenting facility was now complemented by a free online publishing platform[114] which made plan documents easier to read online and required commentary by email. The boundary rule (e.g. registration requirement) for the planning portal was eased, however it also meant that planners would have to edit comments manually.

In the future commentators would be able to access each other’s comments only after the consultation close. With regard to the technical infrastructure, G. Taylor [process support] noted that she “stuck it all together, but it's not quite as smooth as it could be”. Problematically, since the online commenting facility was being phased out, soon hyperlinks in the map would no longer work and thus changing the technical infrastructure created substantial and additional work to replicate lost functions across the different, incompatible ICT facilities available to the planners.

[114] Issuu.com

6.8 Views from the outside

Reversing our view and looking from the outer circles of engagement inwards, we now draw upon a select number of study participants in their attempts to influence the document development process given their own ICT facilities and rules-in-use. Representing the dilemma for planners in organising opportunities for participation, study participants described diverse participation practices in their attempt to influence the process. This resulted from their respective familiarity with the process, the context of their organisation, and their access to ICT facilities and digital literacy.

Despite their diversity, we nevertheless found that the set of citizens who participated in our study could be linked by their patterns of interaction. Citizens within villages distributed across the rural parts of the district showed a primary interest in topics that related to their immediate vicinity (see CHAPTER 5). When we analysed the segments of texts that different citizens commented on in the two planning documents we found a network that could link all participants included in this study by such relations (see APPENDIX III). Given that text segments could either have a geographical or topical focus, it reflected many instances of shared interest in a geographic and/ or subject area[115].

The research design was sensitive to the participants' relation to the area in question and here we draw on their location to compare and contrast the practices of participating in the process. Indicated by the dimension "primary locale", we stress how the plan development is an example of an information resource with location-contingency and thus provides opportunities for both off- and online-interactions as is apparent from the eleven workshops in stage two and online consultations later. In analysing participant data, we drew on concepts from Activity Theory (AT) to attend to the socio-technical context of study participants' practices of participation (Bertelsen and Bødker 2003). The framework assumes the existence of a goal-oriented activity which in this case is the attempt to influence the content of planning documents. "Rules" of participation are thus influenced both by the planners' guidelines as well as the participants' socio-technical context, including guidelines given by their employer.

6.8.1 Situated participation(s) - participation from within the district

Out of 359 Lancaster-based contributors, 83% (or 300 individuals) were citizens without an organisational affiliation (see Figure 22). Usually local contributors were more

---

[115] Subject areas included transport planning, residential developments, green issues, employment land, building standards, etc.

interested in the spatial planning document, which was for them easier to understand in comparison with the detailed document listing the general development policies. Previously we found clusters of citizen activism in the somewhat neighbouring villages across the district and commenting patterns were more focused on areas in the vicinity of these villages (such as Silverdale and Carnforth, see CHAPTER 5).

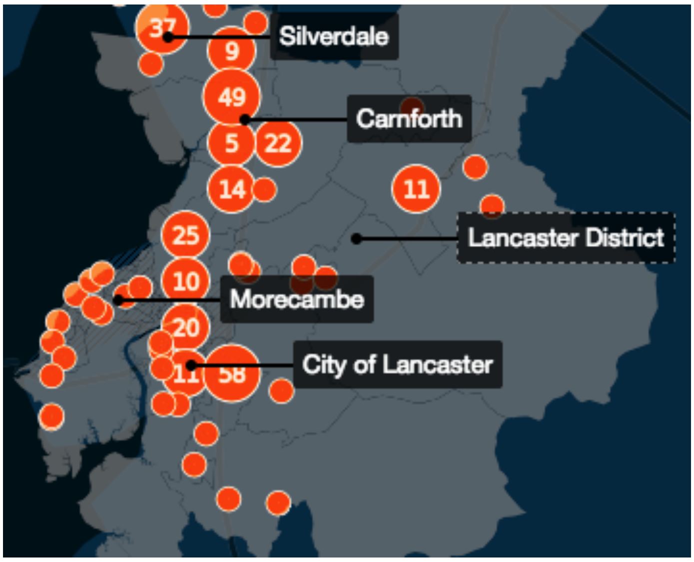


Figure 22: Cluster map of contributors situated within the Lancaster District (target area for the planning process)

D. Simpson is a young, local resident who moved into the area six years ago. As a semi-active participant, he got involved only in a 'snapshot' of the process by participating in workshops on behalf of the local university. He discontinued to participate in later stages, but was otherwise active in following activities in local community groups and ecology projects. He thought that the facilitated workshops were all about capturing voices, but it could also have been done by "going out to things that are going on locally / [...] literally just recording, taking snapshots of conversations rather than formally asking people to work on themes. [...] I think some people voice opinion on these issues without knowing that they are doing so, but you need to be [...] in the right place at the right time [...]." Most of the later interactions were largely static documents that could not represent the citizen dialogue in workshops that D. Simpson was interested in. This interaction appeared common for many politically-active residents within the district.

Long-term resident A. Arrowhead [community group member] used to be a local councillor. When she stepped down, she decided to narrow her participation onto only one single local issue that was happening in her neighbourhood, and "let other people cope with the other stuff". Motivated by local community interest she contributed a comment to try to safeguard a local recreational land from development. This land was owned by a private investor, and, until a year ago, had open access and people rode quad bikes around it until fences went up causing many locals to be upset. Knowing about planning and being familiar with the council's online commenting facility, A. Arrowhead served as a mediator for the interests of a 70-member community group and its circle of eight senior members. Using a simple mailing list, she coordinated their response: "What I did was draft something, then copied it into an email, circulated it to the rest of my groups, and said 'are you OK with me saying this, is this what we think', had a little bit of a debate about it, and then submitted it after we had that discussion." While emailed newsletters were important, she drew mostly on the local community blog and her personal contacts at the municipal administration.

Local resident D. Sampling [representative of the county council] on the other hand had no choice to participate in the process at the final stage. He was assigned to become a liaison to the planners in Lancaster. Being a compulsory task, he thought it took 2% of his daily tasks. He did not enjoy it, but appreciated that it "forced" him to consider the district's future. Specialist mapping software and professional planning colleagues in his team supported his commentary to determine the possible implications of various road infrastructure plans. He followed an "internal protocol" with indicative timescales to solicit the opinions of a range of council professionals and then drafted an overall "narrative" of the council's combined views and his own knowledge of the local environment. D. Simpson already had experience using the online commenting facilities and he thought that was probably "the most useful for planners" since it would be easy to process, but it required him to break up his narrative in several comments that he had to submit separately, causing him additional work.

6.8.2 Non-situated engagements - participating from a distance

Across the four phases, 180 individuals contributed from outside the geographic area on behalf of organisations (see Figure 23). The seven participants in this study represented either national organisations (government agencies & charities), landowners, developers and consultants, that fit to Healey's (2006) description of the "planning policy community". The developers and consultants were all located outside the district. Non-situated participants accessed the processes mainly through desk research, occasional local visits, and telephone calls with core organisers. Some study participants reported advanced ICT-supported workflows and covered areas of interest that went beyond that of the Lancaster District.

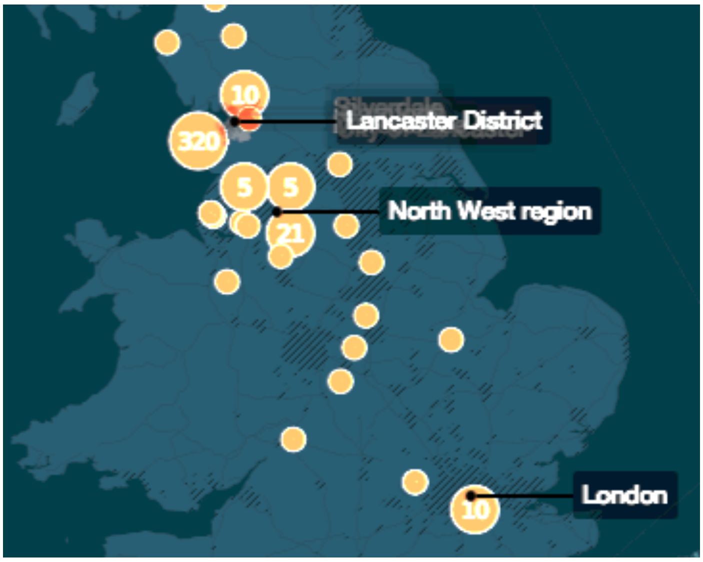


Figure 23: Cluster map of the UK with all non-situated contributors

Manchester resident J. Darter [English Heritage], a planning professional with 35 years of experience, was one of the most regular contributors who participated in all stages, except for the workshops. Representing a national charity, he was regularly fed local updates by a team of park rangers . He had access to ICT facilities such as a GIS system with references to property ownerships across 80 authorities in the region, which effectively represented his reason for participating. He kept a systematic file of his past contributions. Through his set-up he was able to handle consultations for the 80 authorities in his geographic patch simultaneously. He mostly used emailed forms to comment, since he found the online commenting facility unconducive for the "iterative development" of comments. He submitted a number of strategically placed supportive comments in combination with occasional telephone calls with the planners to get an "informal understanding" of the council's perspective and to express his views.

Likewise, developers and consultants such as R. Ryan [developer] preferred to participate online. "Save for the workshop, I've participated in a way that just involved me sitting at my desk obviously using work time to do that. I suppose residents might prefer to turn up to an event or having a workshop [...] but for me it works well. The website is available all day every day and the documents raised awareness to specific questions for me to answer". For the online consultations she drew on a specialist, paid-for aggregation service that flagged consultations nationwide. She used a systematic process for storing copies of past responses so that for each comment she stored copies in her company's database. Similarly, W. Lane, for seven years a Manchester-based planning consultant, used an email archive and a job filing system to track his participation with Lancaster. Together with his co-workers he responded to concurrent consultations across several regions for which they used an iterative reviewing process. He noted "even within our own comments internally there are drafts that are evolving so that we ensure different people's interpretations and perceptions are taken on board and incorporated within our commentary". He made his comments by email as they were too extensive for the online commenting facility. As they were too difficult for planners to summarise, additional in-person conversations followed. He did not have problems contributing to the process, being able to call the planners when needed.

Lastly, study participant E. Williams [Coal Authority] served as a final extreme example of remote participation for a government agency. As the head planner, she managed six professionals, handling 550 consultations from 180 local authorities annually nationwide. A bespoke in-house work scheduling system was indispensable for the team to participate electronically in a consistent manner. Once a new version of a plan document was available, documents would be automatically downloaded into their ICT facility creating a workflow in which one team member would be assigned as the lead. The ICT facility overlaid geo-references of historic, current, and future coal mining from a national database and notified other departments. This facilitated aggregation of expert information. She noted that the system "doesn't reduce time (needed to respond to documents)" but facilitates the process by flagging "to you you've previously seen this version, this version, and this version".

6.9 Dilemmas in ICT-supported collective action

The preceding analysis of the plan-making process analysed the information system first from the planners outwards to citizen contributors. In reverse, it then looked at the practices of participation by considering a small number of citizen contributors. Diverse practices and preferences of access became apparent across the study participants that highlight the dilemmas of information systems for collective action. In the following I will discuss the outcomes in relation to the two analytical research questions. This concerned the governance of the organisation of participation activities and the related information space for citizen participation and the diverse practices of citizen participation that were observed.

6.9.1 Organising for collective action

Using the IAD framework (Hess and Ostrom 2006), we systematically categorised operational and collective-choice influences which shaped the public-facing information space. The dilemmas of exclusion and inclusion to this public information system are seen in the nuances of their multi-level institutional governance. Appreciating these layers is essential in developing Monteiro et al.'s (2012) "extended design view" of the infrastructure and ensures that design interventions in such complex IS can be better informed. The IAD framework's origins in commons analysis (Hess 1995) is relevant to comprehend the difficult dilemmas of the equity, efficiency, and sustainability of participation in the development of the infrastructures and the information resources for societal relevance.

The practicalities of participation vary based on the skills of the planners (F. Fischer 2000). Here we were interested to understand how the information space provided by planners and others was changed and modified. This followed Saad-Sulonen's (2012) understanding of planning being both about sharing of digital media and the configuration of underlying ICT facilities.

Our study illustrated the planners' role in configuration of different ICT facilities that sought to serve collective action. All employed ICT facilities, that made up the technical infrastructure and were used to promote information access but revealed the capacity for direct edits. In formal online consultations, this requires all formal interactions by citizen to go via the planners by submitting comments. Direct cross-communication is unsupported. This is limited by the fact that contributing citizens do not state their participation interests either by subject or geographical focus. This is indicative of the fact that planning as a process currently poorly supports technology-supported collective action and would thus be unsustainable without the municipal planners' professional mediation.

Laws made provision for contributors to participate in making collective choices relating to the ICT facilities used. In theory it is done by commenting on the council's consultation 'manual' ("Statement of Community Involvement"). Planners' weekly meetings served a similar function to what was described as temporary common information spaces in which all the required resources and knowledge were brought together to make informed infrastructural decisions on behalf of all (Rolland et al. 2006). Decisions relating to the set-up of technological facilities were initiated by the planners as core organisers in response to critical citizen feedback. Hence collective choices, that would affect all participants and their practices, were made by planners in an attempt to listen to customers. This indicates a dilemma as the attempt to broaden participation by removing technical limitations will likely create additional complications resulting from a fragmentation in the information space resulting in temporary limitations as external participants learn and adjust to the changes.

6.9.2 Citizens at the gate

Although the experiences of the sample of study participants included in this study cannot be generalised to each participant, the study has shown that citizen contributors are embedded within their own information system, generating their own internal collective action(s). Mostly this involved mundane practices, such as email archiving, organising of shared folders, distributing newsletters, and a myriad of face-to-face meetings. The object of interest beyond the plan documents was the geographical space they sought to affect and, hence, space in itself and social relations with space seemed to present a socio-cultural infrastructure to support citizen participation.

Detailed analysis of participation practice of local residents offered a mixed picture. On the one hand, it suggested that locally-situated individuals could rely on many face-to-face interactions and thus relied less on the ICT facilities provided by the planners and could tap into public information meetings. However, these often remained what they were - meetings for information. Local participants tended to exhibit inconsistent participation. In terms of the technical infrastructure, many who commented for the first time seemingly faced significant hurdles such as the requirement to register on a commenting portal.

On the other hand, non-situated participants (participating remotely), were mostly paid-for professionals, that used systematic, mostly simple, but effective techniques that helped them engage and navigate the constraints of the planners' ICT facilities. For instance, mundane but systematic email archiving practices enabled logging of their interactions in previous stages. To do so, some had access to special information facilities which helped in coordinating contributions amongst several individuals. These participants comprehended and monitored issues in documents by having the time and resources to study the documents in detail and relating them to objects of interest by tracking those in bespoke databases (for example the coal authority's national register of past and present coal mining), something local contributors were less able to do. Additional paid-for notification services supported their awareness and ability to respond to planners directly, and to avoid a reliance on the publicly accessible technical infrastructure.

6.10 Conclusion

In this article we presented an "extended design view" to the organisation of participation actives in planning. This meant considering the use and configuration of technological facilities that facilitated participation in changing plans, as collective artefacts in a participatory manner. Analytically, we saw the plan development process through an institutional perspective to highlight the social rules which, in combination with the technological facilities, enabled or hindered participation. Based on a number of tracing techniques, the IAD framework has been useful in studying this information system, in which motives, actions, and practices of the citizen contributors are outside the direct control of the core organisers. As there are no direct financial incentives to participate, planners need to provide opportunities to participate that are easy to access and that match the citizens' abilities, but even more to put in place ways for finding usability issues deficiencies in the technical infrastructures that potentially exclude non-exert groups.

The plan information system for the development was supported by a heterogeneous publicly accessible information infrastructure which planners constructed primarily by linking several mundane non-compatible ICT facilities to serve an information space susceptible to collective action. We've learned that for accessing the urban planning process, local participants were mostly semi-active or even passive participants relied who *in particular* on ICT facilities provided by the planners. Their primary resource for participation is often the local environment, and the situated knowledge in terms of content but, beyond that, it is in relation to the *process*, and the people they know who bring the process to their attention. On the other hand, organised stakeholders often draw on a specialist set-up of ICT facilities and practices which facilitate tracking of objects (such as sites) or topics of interest.

Our analysis indicated barriers to collective action in the institutional structure as well as in the technical facilities used that made up the information space. Now, self-governance in planning seem to be farfetched in light of the many technical, institutional, and subject-specific barriers. While citizen participants indicate 'entrepreneurial' spirit by getting involved in planning, having their own capacities to organise resources at hand, such practices should be better supported if the information systems in planning want to be amenable to participation beyond the current circles of semi-active participants. Stepping beyond may mean breaking down barriers in between citizen communication and catering for institutional practices, which support locally situated participants through complementary technical infrastructures that reflect space as a valuable social infrastructure for engagement.

6.10.1 Limitations and future work

A number of limitations should be noted regarding this case. First, the make-up of the administrative area considered in this study is characterised by a lack of situated organisational or professional contributors. This will likely be different for larger metropolitan areas, which are home to a larger share of investors and developers. Additionally, while the application of the IAD framework worked well since we were analysing a fairly stable institutional ecology, its application needs to be adapted to more dynamic contexts, where participants and organisational forms and IS governance are volatile or rapidly evolving, as it may be in crisis informatics.

Future work should consider examples of non-traditional information systems constructed for other purposes than planning, including local currency schemes, participatory sensing initiatives, shared mobility initiatives including bike- and car-pooling services, and many more. Through case studies of institutional structures and technical arrangements in other contexts using the IAD, IS literature will be able to systematically catalogue different examples of information infrastructures and enabled the development of design guidelines for equitable, efficient, and sustainable systems. This should consider the kinds of information artefacts produced, the underlying ICT facilities employed, and trace how information is produced, consumed, curated, governed, and assembled into collective outcomes. It is this large scale collective action which interacting digital technologies, employed as information infrastructure in and for the public sphere, allow.

TRANSITION

Following on from a detailed understanding of an established planning process and its spatial and institutional configurations, the next article analyses technical and institutional challenges faced by two technologists in applying new forms of participation in a planning context. This is demonstrated by two cases of online platforms. One was a location-based service that used a mobile application for collecting citizen responses to the planning of a natural park; and the other an online mapping portal that enabled a local community group to garner participation for a bottom-up planning project in Helsinki, Finland. Skype interviews were conducted with the two experts using an interactive data entry form of the Institutional Analysis and Development (IAD) framework both as a probe and interactive interview guide. I analyse these new approaches to citizen participation on the two levels of design and use. Based on the analysis, I suggest that future projects for new forms of participation need to consider existing institutional actors actively throughout the design process although the technologies are fundamentally developed for non-expert citizens.

On examination of my work, it was suggested that the following article should be seen as “a dialogic tool to think reflectively and critically *about* participation and participatory technologies” due to its contrast with the previous two empirical chapters. The paper serves as a critique of the potential benefits often assumed to underlie the various online-supported new forms of participation discussed in the earlier part of this thesis. Although the data in this paper are limited to two interviewees, the analysis demonstrates the imbrication of the technical interventions within a multi-fold socio-material context that was shaped by the research in which it was employed. The article documents the challenges adopting location-based systems linking various community groups with a formal established institution. It was seen as a contribution to knowledge that this article could further enhance, but in particular it also challenges assumptions underlying the arguments for self-organisation practices through and with technology-supported interactions.

The institutional analysis methodology employed in this analysis is found to be helpful in differentiating between different levels of ownership on the part of the platform operator for such a technology (e.g. the local authority) and individual community groups making use of the platform within their specific group setups. Thus, the study differentiated between the establishment of rules that apply to the platform as a whole, mentioned as collective choices, and those that are made by individual user groups, mentioned as operational choices. The examiners recognised an important insight about the contribution of the next chapter. In light of the detailed analysis in the past chapters, the study here was “rather used as a dialogic tool to think reflectively and critically about participation and participatory technologies.” However, read in conjunction with the previous analysis of the Lancaster planning case, especially the knowledge that data from established engagement processes can be used to present a geospatial analysis of participants, thereby helping to identify various citizen groups around specific local matters of concern that could perform as user groups for the platforms described in the following article. Doing so, the insight gained from this study sends a powerful message to established actors as to what pitfalls are presented by engrained institutional practice. In terms of the development of my early thinking of the role of local non-expert actors in information governance, the paper helped to substantiate the importance of third party actors. These actors may be the municipal planners resolving planning matters on behalf of the various actors in society. They may also be specialist third party platform operators that specialise in overcoming and resolving the many governance and technical challenges in operating software online that aims at easing collaboration and coordination among large, diverse groups of non-expert actors of widely varying expertise.

CHAPTER 7

GEOSPATIAL TECHNOLOGIES IN MUNICIPAL PLANNING — CHALLENGES IN INSTITUTIONALISING NEW FORMS OF PARTICIPATION

"GIS, like the astrolabe[116], is a more complex tool than is needed for many purposes. Its ultimate impact will depend not only on the way the tool is redesigned, but also on the reform of educational systems, of record-keeping practices, and regulation and planning activities, as well as on a clear, shared vision of the changes GIS can and should bring about." Innes (1993)

7.1 Abstract

Research on location-aware mobiles and/or online mapping has conceptualised new forms of participation in spatial planning through concepts of "action & reflection", "in-situ participation", and "multiple participations" with technologies, such as location-aware mobiles and/or online mapping. By offering frameworks for sharing and visualising citizens' comments by location, those technical interventions link off- and online interaction amongst members of the public on various matters of shared concern. Numerous cases evidence the struggle of embedding such systems between the planners' work and citizens' everyday life. Yet few studies analysed the multilevel institutional and technical challenges in such interventions. Encouraging a discussion of technical intervention's sustainability over time, we contrast two experts' experiences in building digital infrastructures for new forms of citizen participation. From their standpoint as platform organisers, we find challenges in establishing, advertising, and sustaining the technical intervention with established institutions and their embedding into community groups. We suggest that understanding of sponsors, such as existing institutions, and sensible distribution of ownership is essential for the technical intervention to 'find a home'.

Author Keywords: urban computing, adoption-centred design, research impact, participatory geographic information systems (PGIS), digital infrastructures, self-organisation

---

[116] Def, Oxford Dictionary: "An instrument used to make astronomical measurements, typically of the altitudes of celestial bodies, and in navigation for calculating latitude, before the development of the sextant."

7.2 Introduction

Over the years, new forms of political participation have been suggested that emphasise collaboration of diverse actors across various social and local contexts. Brun's work on "networked publics" argues that politics changes to "poly-dynamics" with multiple co-existing centres of activity (Bruns 2008). In urban planning, "self-organisation" proposes that various (informal) community organisations[117] take ownership of matters of concern relevant to their social cause and geographical area (Boonstra and Boelens 2011). New forms of participation were associated with the ability to name and visualise complex social phenomena, facilitate a 'sense of place' through personalisation, facilitate self-organisation supported by peer-to-peer reputation systems, and help manage collective action (de Lange and de Waal 2013). In most cases, such concepts imply both institutional and technical adaptations simultaneously that technology-led research projects often poorly consider.

In this article, we base our discussion on interventions in municipal planning with online geospatial technologies that sit at the boundary of political organisations and various publics. Modern geospatial technologies combine social networks with a geospatial framework to contextualise users' interactions with geographic information. In collaboration, such systems draw on the materiality of geographic space as a socio-cultural infrastructure for memories, associations and feelings associated with particular places (Dourish and Bell 2007). By being online, they may hide their technical complexity (compare Innes and Simpson 1993) and reduce maintenance requirements for the end-user (Dunn 2007). Nevertheless, their application, for example, for local government has been hampered by the competing ends that such systems seek to serve between 'professionalised' organisations and the public (Bugs 2012). They usually require balancing competing political and commercial interests of various stakeholders (Ojala et al. 2010)

Following the discussion of sustainability of research-led HCI interventions (Chilana et al. 2015), our aim is to understand institutional and technical hurdles that new forms of participation face in the multi-institutional context[118] of urban planning. To do so, we follow a 'macro-HCI approach' (Shneiderman 2011) contrasting statements[119] by two

---

[117] Non-profit, non-governmental groupings for a particular social cause.

[118] In this article, the multi-institutional context is divided into the 'governance' level of such technical intervention and its 'use' by various citizen groups.

[119] For the thesis, these statements express existing practice across these two cases that can contribute towards recommendations for embedding new forms of interaction. As in the previous two

experts, who developed and applied technologies ("technological interventions") aimed at forms of participation consistent with "self-organisation". Using institutional theoretical[120], we trace the *governance* and *use* of two technical interventions in retrospect on the levels of the sponsoring organisation and various user groups within society. The first case shows the implementation of an "in-between infrastructure", a map-annotation service for citizens to submit location-referenced media (comments, photos) linked to specific planning problems that could be initiated by anybody. The second case involved a mobile application for citizens to share location-referenced comments, a web portal to review all user-generated content on a map, and QR-tags[121] placed at various locations that lead citizens into and out of the service. This comparison study followed an in-depth case study of established forms of participation in spatial planning in the UK (see CHAPTER 5 and CHAPTER 6).

7.3 Related literature

We highlight the role of community groups[122] in planning. For ideas on possible new forms of participation, we draw on literature on community-based use of geospatial technology, such as geographic information systems (GIS). Finally we develop a summary of institutional and technical challenges that become apparent in new forms of participation in planning.

7.3.1 Taking ownership of planning locally

Boonstra et al. (2011, p. 106) argued that modes of participation in urban planning have evolved from "consultation, via collaboration towards a sort of delegated

---

chapters there's a link to technologies but also techniques for using geographic context as a vehicle for further voluntary participation.

[120] We applied an adapted version of Ostrom's Institutional Development and Analysis (IAD) framework (Ostrom 2005)

[121] Oxford Dictionary (2014) definition: "A machine-readable code consisting of an array of black and white squares, typically used for storing URLs or other information for reading by the camera on a smartphone"

[122] The focus on 'community groups' has been a long-running thread in disciplines, such as geographic information systems (Talen 2000), but also community informatics (Gurstein 2007). In the concept of urban informatics, the focus on community groups was critiqued by de Lange et al. (2013) as being associated with small towns. However, in this thesis the concept of 'community' feels appropriate due to the focus on individuals proximate to matters of concern. In CHAPTER 5 they were referred to as "place owners".

management", yet, even the most interactive forms of participation remain "within and therefore are also based on government regimes". They thus involve cycles of lengthy consultations[123], complex administrative hierarchies and a lack of shared decision making. At the same time, socio-political changes[124] and the diffusion of digital technologies in society call for new approaches to participation (Innes and Booher 2010). Based on Foucault (places being owned by different constituents and thus entangled "struggles over whose 'reading' of space should take priority"), Boonstra et al. (2011) suggest participation should happen as self-organisation by citizen groups who emerge as voluntary participants in, and initiators to, the resolution of matters of their concern.

Community groups play an important role in a wide range of 'local' matters, such as local parks, school reform, graffiti removal, noise ordinances, and many more — often in relation to a locality (Durrance et al. 2006). For example, Taylor et al. (2015) document a case of residents organising the creation of a data archive for a local road. They support information sharing and filtering between the political institutions and local residents (Durrance et al. 2006) and are valuable partners in the implementation of government policies (Rideout et al. 2007). Coordination and cooperation on shared matters appear critical in enabling local actors to take on additional political responsibilities often voluntarily from the 'bottom-up' (compare Boonstra and Boelens 2011).

Possibly due to the ambiguities as to what community groups can achieve (F. Fischer 2000) doubts are raised over the capacity of local self-organisation. Also, community organisations' use of ICTs in volunteer-based work remained poorly understood (Voida et al. 2015). To overcome their limitations, partnerships between groups and organisations in a locality enhance the context for bottom-up participation (Rattray 2006). For example, Fisher (2003, p. 302) argues "a viable community network results in a critical mass of organisations that understand its functions and contribute to its success. When these conditions occur the community network can make strong contributions to community building by bringing organisations together, thus strengthening organisational partnerships."

Linkages across localities and with established institutions are important too. Rattray et al. (2006) called for data sharing partnerships between political institutions and informal groups to establish a successful information ecosystem between various

---

[123] How this works has been analysed in CHAPTER 6 which illustrated the lengthiness of preparing two policy documents involving four phases of consultation over the course of several years.

[124] Such as the growing diversity and education levels of the public (Innes and Booher 2010)

community groups and governmental agencies. Here, self-organisation requires the recognition of community groups' presence and acceptance of their rules (Hess and Ostrom 2011). At best, support of 'bottom-up' citizen participation calls for formal recognition through legal schemes (F. Fischer 2000), such as neighbourhood planning[125] (Parker et al. 2014), Business Improvement Districts, or co-operative housing (Boonstra and Boelens 2011). For example, groups who got involved in neighbourhood planning developed capacities to take ownership of local planning decisions by learning the technical language of planners and by organising processes, techniques, and technologies for making local plans (Parker et al. 2014).

7.3.2 Use of geospatial technologies by local communities

In planning, bottom-up uses of geospatial technologies within community groups have been proposed (Talen 2000; Leitner et al. 2002; Dunn 2007). Participatory geographic information systems (PGIS) have sought to offer communities support in mapping out complex social phenomena spatially (Sieber 2006; Rambaldi et al. 2006). Contemporary online-accessible systems combined the functionalities of PGIS with those of collaborative mapping platforms, that visualise location data online and offer mobile access (location-based services).

For non-experts, a non-technical approach to geospatial technologies is necessary (Talen 2000). In two cases in the USA, Talen (2000) offered an example of how this might work. In intensive one-day workshops, students helped a community group customise a popular desktop GIS by co-designing markers (such as bus stops, accessibility barriers etc.) together with citizens. In a second workshop, citizens expressed their perceptions of the neighbourhood by using the newly configured interaction space (for example in terms of 'accessibility', perceived safe/unsafe areas, popularity and aesthetics). By combining formal information (property information, population densities) with the residents' perception, this approach could articulate complex constructs (such as safe/unsafe areas) and resulted in multiple alternate versions of shared physical spaces. This case provided an example of 'local' embedding in which the local community began to take ownership of their matters of concern and, in turn, a technology that supported them in doing so.

Compared to Talen (2000)'s approach, projects in computing have sought to combine the capability of mash-ups using Google Maps (Nuojua 2010), collaborative online

---

[125] In the UK, neighbourhood planning enables local individuals and group actors to develop 'neighbourhood plans', sets of policies developed for their geographic area. As of April 2014, 1000 communities in the UK had begun to prepare neighbourhood plans.

mapping on planning issues (Saad-Sulonen 2012), and the use of mobile-phone as an extension of web mapping to the physical space (Bohøj et al. 2011). Such general purpose systems are accessible to a large and diverse public across a wide area. As a result, the researchers were challenged to cater to various participation incentives and unknown goals, occasionally involving several municipal administrations. They had to navigate a complex set of 'institutional relationships' (with politics of multiple competing agendas) making the development of partnerships essential. Facilitating the Internet, these applications assume a permanence, becoming part of an ecosystem of technologies to support citizen engagement as 'micro-participation' via short messages from smartphones (Nuojua 2010), and "action" (within the place participation helped by technological means) and reflection. These interventions exploit the awareness of physical proximity and location to facilitate participation in planning concerns and have the ambition to support a self-organised (community-based) planning process. Such projects question established rules and structures of practices in favour of revised institutional set-ups in which planning issues are open for anybody to initiate, planners and citizens alike (Saad-Sulonen 2012).

7.3.3 Issues for distributing ownership over participation

Simply intervening technologically (such as with GIS) rarely leads to increases in participation (Kubicek 2010; Bugs 2012). Technological interventions need to be embedded appropriately within the social and technological context(s) to instil ownership. Overcoming these challenges requires thorough consideration of how to embed the technology within existing participatory practices, engage with the socio-political predispositions of citizen groups and provide easy-to-use interfaces (Albrecht 2006).

Local ownership could be an opportunity for and benefit of community-operated technologies (Leitner et al. 2002). Leitner et al. (2002) knew of a few cases of community GIS centres where "governing principles [...] would [...] be set by the community organisations which it serves, and that it provides those organisations with the capacity not only to gain access to pre-existing databases but to input information gathered by the communities themselves." This draws attention to scale and level of organisation of community actors as well as to the establishment of links in the application of such new forms of participation crossing 'local' and 'global' as well as informal and formal organisation.

Related to future digital infrastructures, we concur with de Lange and de Waal (2013, p.3) that ownership could emerge as a construct focused on inclusivity, "that one has the right to act upon an issue". Some speculate that voluntary participation may arise if a sense of ownership of matters of local concern arises (Dunn 2007).

7.3.4 Summary

We have summarised some known challenges in using geographic information systems shared across a range of users in Figure 24. The overview is broken down into both technical (related to the aspects of scaling, integration of ICTs) as well as institutional (related to established patterns of interaction, organisational questions) considerations, although we acknowledge that the boundaries are variable. Unfortunately, in practice most the the technical and institutional challenges are deeply intertwined being part of social practice, one shaping and being shaped by the other.

Technical challenges *(Scaling, data standards, integration)*	Sharing of authority (changing working culture of established institutions, lack of technical skills (Bugs, 2012); Unresolved data ownership questions (Shilton, 2012); Lack of data sharing partnerships (Rattray et al., 2006)
Institutional challenges *(Rules & habitual practice, organisation, technical support)*	Conflicting technology space; costs associated with supporting many interfaces, data security (Rattray et al., 2006)

Figure 24: Known technical and institutional barriers to bottom-up GIS use

Challenges of adoption, scaling and organising patterns of interaction reoccurred in previous examples of PGIS-like tools, like ArguMaps (Rinner 1999; Rinner and Bird 2009), Planning-for-Real-PPGIS (Kingston et al. 2000), WebMapMedia (Nuojua 2010; Molin-Juustila et al. 2008), mobile democracy (Bohøj et al. 2011; Korn and Back 2012), Urban Mediator (Saad-Sulonen 2012; Saad-Sulonen 2010b), and the Open311 system in Helsinki. Except for Open311, most research projects failed to be adopted sustainably (by that we mean incorporated into daily long-term use). Instead, distributing ownership in and through these interventions may overcome the institutional and technical challenges and could suggest an exciting future for politics of a networked public(s).

7.4 Case study methodology

Our methodology follows a cross-case comparison of the experiences of two individuals who embedded new forms of participation in municipal planning. For case selection, we used three criteria: First, the case shows evidence of a new form of participation supported by automatic or manual computational support (integration by "hand"). Second, the case resulted in a shared information product and related meta-information (e.g. number of participants, number of interactions). Third, it garnered participation towards a shared matter of concern by involving a number of citizens voluntarily (i.e. not explicitly invited), so that it was part of a call for participation.

Two matching cases from Scandinavian[126] countries known for radical approaches to democracy were chosen[127]. Two expert informants told us about their attempts at implementing, configuring and fitting a technological intervention within a multi-institutional context. With both individuals, we conducted interviews via Skype, each lasting 1.5 hours.

7.4.1 Method for data collection

We employed a synchronous Internet-based interview in which the participant and the researcher communicate in real-time over the Internet (O'Connor et al. 2008). O'Connor et al. (2008) suggest that this data collection method offers opportunities for 'spontaneity' beyond asynchronous Internet-based interviewing (such as by email) and encourages "honest" answers since there is limited time to consider or revise statements. Unlike O'Connor (2008), who relied on chat clients, we used video and screen sharing functionalities (of Skype) for depth and interactivity that overcome limitations associated with a the lack of visual and gestural cues.

Video interviews approximate face-to-face interviews by providing a 'visual element' to the online interview while retaining advantages of telephone interviews such as flexibility in venue and the comfort for the study participant to remains in his/her personal environment (Hanna 2012). Due to the rapid advances in Internet connectivity, speed and easy-to-use chat software, online video interviews become a viable and robust alternative to traditional face-to-face or phone interviews (Deakin and Wakefield 2013). Drawbacks of online interviews, such as higher rates of absent participants in comparison to pre-arranged face-to-face interviews (Deakin and Wakefield 2013), were avoided in this study as the interviewees were familiar to us. Anonymity, usually considered as a strength of the online interview method, was a lesser concern and rapport was built in advance.

For online research, interactive prompts are well documented in the literature and were used, for example, in online surveys to build rapport (O'Connor et al. 2008) or to

---

[126] The present examples here are placed within a different national context, meaning that at times there are variations in the philosophical underpinning to (citizen) participation and democracy compared to the UK case presented in the previous two chapters. Within this thesis, this article therefore serves as a *critique* of embedding technology-facilitated forms of interaction rather than a *comparison* with the UK case, which is not the intention.

[127] It helped that we had pre-existing personal relationships with each of the two individuals. Additionally, their projects are described in published academic literature which helped to provide additional facts for each case.

increase the quality of responses to open-ended questions (Oudejans and Christian 2010). Surprisingly few descriptions exist of scholars combining visual prompts and online video interviews. To strengthen the visual element of the two interviews, video interviews were enhanced by use of screen-sharing functionality to display an interactive interview form, that served as a structure for participants' responses (see APPENDIX VI for details on its development and use). Hence the conversation with participants resembled interactive interviewing methods, described as "a conversation in which the researcher and the study participants engage in a joint sense-making and emergent understanding by mutual disclosing, sharing personal feelings, and social experiences with each other" (Hesse-Bieber, p293).

O'Connor et al. (2008) warn that online interviews result in 'written conversations' as relevant answers to a question may occur at various instances in a synchronous online-based interview. We mitigated this risk since the online form helped to structure the narrative collaboratively. Participants saw guidelines for each form field, observed our note taking, and occasionally asked clarification questions. This helped us and the participants to relate their case accounts to the concepts in the theoretical framework.

To ensure the interview form met our expectations, we undertook two trial interviews with experts with similar projects (a crowdsourcing video platform[128] and a participatory mapping project[129]). The data from these interviews helped in developing the interview form prior to real-life use and its inclusion here was not considered necessary. Further, it served as valuable interview training through which the applicability and use of concepts within the form became apparent. The trial interviews showed that the intricacy of the topic domain prohibited an unsupervised method of data collection.

7.4.2 Theoretical framework

Data collection and analysis was guided by an adapted version of Ostrom's Institutional Analysis and Development (IAD) framework (see CHAPTER 4) that provided us with key concepts and structure to the interview. The term "institution" describes a set of rules that indicate how collective outcomes were derived (Hess and Ostrom 2011). Such an institutional view provides a "theory of social dynamics" (Healey 1999) and highlights how social actors created the *context(s)* for their own actions. As Healey further points out,

---

[128] LifeMirror, see lifemirror.org

[129] LucidLancaster

“systems” (i.e. social organisations) “are not given, but are made, in a complex interaction between the imaginary and the material world.”

In our case, the institutional view highlights the power relations between platform provider, community groups and established political institutions. It does so by asking who participated in designing the technological intervention (such as the geospatial service); who participated in embedding the technology into existing processes and institutional constraints; who participated through data contributions; who participated in evaluation of contributions and so on. Study participants were told that we are seeking to understand the technical and institutional factors that they considered in the design and implementation of their platform and their vision of new forms of participation.

The analytical strategy followed three steps: first, reported experiences are associated with ‘action arenas’, sub-cases bounded by networks of interaction between actor groups, ICT facilities, and information artefacts (‘constituents’). For the constituents, open-ended commentary in the interview form enabled us to capture notes on qualitative characteristics. Second, the institutional structures were explored through seven rule dimensions (see Ostrom 2005): position (who was involved?), boundary (how did they become involved?), information (what information could they access? how could they communicate?), pay-off (what rewards could their reap?), choice (what could they do/decide?), scope rules (what outcomes were required?), aggregation (how did interactions between actors result in outcomes?). Third, for each action arena institutional and technical challenges were documented. Although overlaps existed, technical challenges related to provisioning the ICTs, configuration and integration issues. Institutional issues related to deficits in communication amongst the actors, legal and policy requirements, and collaboration issues. For a full description of the framework please refer to CHAPTER 4.

7.4.3 Data analysis

We applied a modified inductive thematic analysis whereby the categories of the interactive framework framed a cross-case synthesis (Yin 2009). The analysis followed three steps. First, we undertook an initial heuristic review of the information stored in the interview form without re-viewing the audio recording of the interview. Second, denaturalised transcriptions[130] were prepared to carefully re-examine notes in the interview form. For each of the two cases, data in the form fields was exported and

[130] In a ‘denaturalised transcription’, utterances as well as grammatical errors are all removed and the interview is stripped back to its bare content.

juxtaposed in a comparison table. Finally, based on the comparison table, we produced reflective notes and concept maps depicting the constituent networks for each of the two cases.

The analysis considered two levels of social arenas[131]: the "operational" and "collective choice" level. The "collective choices" level included interactions related to administration, development and adaptation of the geospatial technologies that underlie the new form of participation in each case (technical systems are further referred to as ICT facilities). In both cases, these technologies[132] were provisioned via the Internet and applied within a community planning context. This community context is conceptualised as the "operational" level where processes of embedding the said ICT facility into the community are considered. The resulting four embedded cases are mentioned in Figure 25.

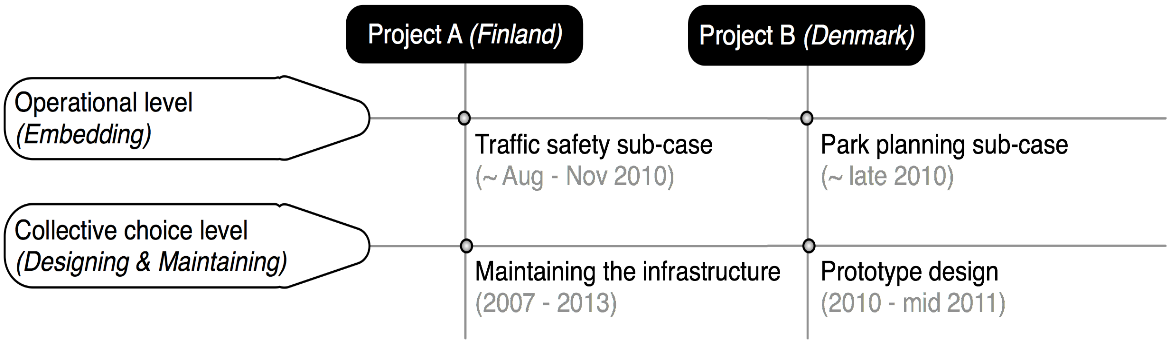


Figure 25: Display of the two cases and two levels of analysis

Interviewees were deeply involved in the collective choice level decisions for which they performed a pivotal role as "core organisers". In the operational level, they were involved as knowledgeable "technology stewards" embedding the technological intervention within a 'real' context (Saad-Sulonen 2012). This vantage point inserts an intentional bias on the technical and institutional challenges in institutionalising new forms of participation from the standpoint of the technical innovator.

7.5 Comparison of two technical interventions

Table 11 provides a comparative overview of key aspects of the two technical platforms associated with each case. At the time of writing, the platform in Project A

---

[131] Occasionally referred to as action arena (see Hess and Ostrom 2011).

[132] This was hosted on university servers.

continues to be accessible online and its source code was open-sourced to allow further development by volunteers (although there was no evidence for this). The core developers for Project B discontinued development after lack of interest from the commercial partners.

	Project A (Helsinki, Finland)	Project B (Jutland, Denmark)
Timeframe	~ mid 2007 to late 2013	~ late 2009 to mid 2011
Status	**Approaching end of life**: system is still available online but without active user base; research-led; it is *open-sourced*	**Now defunct / 'shelved'**: system was active temporary in a restricted-use setting; research-led project; it was *not open-sourced*
Novel form(s) of participation	**Non-situated**: media sharing via the map on the web portal and associated discussion board.	**Situated**: Situated QR-tags & "in-situ" commenting on mobile app; **Non-situated**: reflection via the web portal.
Contributions	Geo-referenced topics, comments, media	Geo-referenced topics, comments, media
Application domain	Urban planning; Traffic safety planning (mostly Helsinki)	Municipal planning; nature reserve planning (mostly on the Danish peninsula of Jutland)
Application type	Online-hosted geospatial service	Location-based service (mobile app) & back-end client
Funding	ICiNG FP6 project (EU) ~ testing of "social software" in government	Danish eGov+ project

Table 11: Overview of the technical platforms involved in both projects

Project A was part of an EU-funded project won by the cities of Helsinki, Barcelona and Dublin that sought to test "social software" for use in, for example, municipal planning. The platform was available online from 2007 to 2013 and enabled the Helsinki government and community groups to collaborate on common concerns by creating, sharing and uploading location-referenced media. Developed as an in-between infrastructure, it allowed citizens as well as city officials to upload and add information.

Similarly, Project B was intended "as a meeting place for citizens to discuss about things, perhaps get the planners involved who might look at it [...] and chime in [...] so citizens would take an active position in coming together and authoring proposals and objections" (statement by study participant B). As part of a research programme funded by the Danish Government, it was linked to applied research institutes as well as three commercial partners. Its development followed the release of location-enabled smartphones[133] and emphasised "mobile technologies" to "involve new user groups into municipal planning". The platform was used in the rural municipality of Jutland (Denmark).

[133] The iPhone was released in 2007.

7.5.1 Making collective choices – designing and maintaining the ICT facility

Outcomes at the collective choice level have direct implications for the functionality and the degree of accessibility of the ICT facility to community groups at the operational level of the analysis (see section 7.5.2). Summarised in Figure 26, we partially mapped the individuals, group actors, ICT facilities and information artefacts that study participants mentioned for this action arena. The interactions between these constituents could affect the ICT facility[134] through "code-level" changes, and alter the configuration and hosting arrangements. They took responsibility for maintaining the capabilities of and accessibility to the ICT facilities over time.

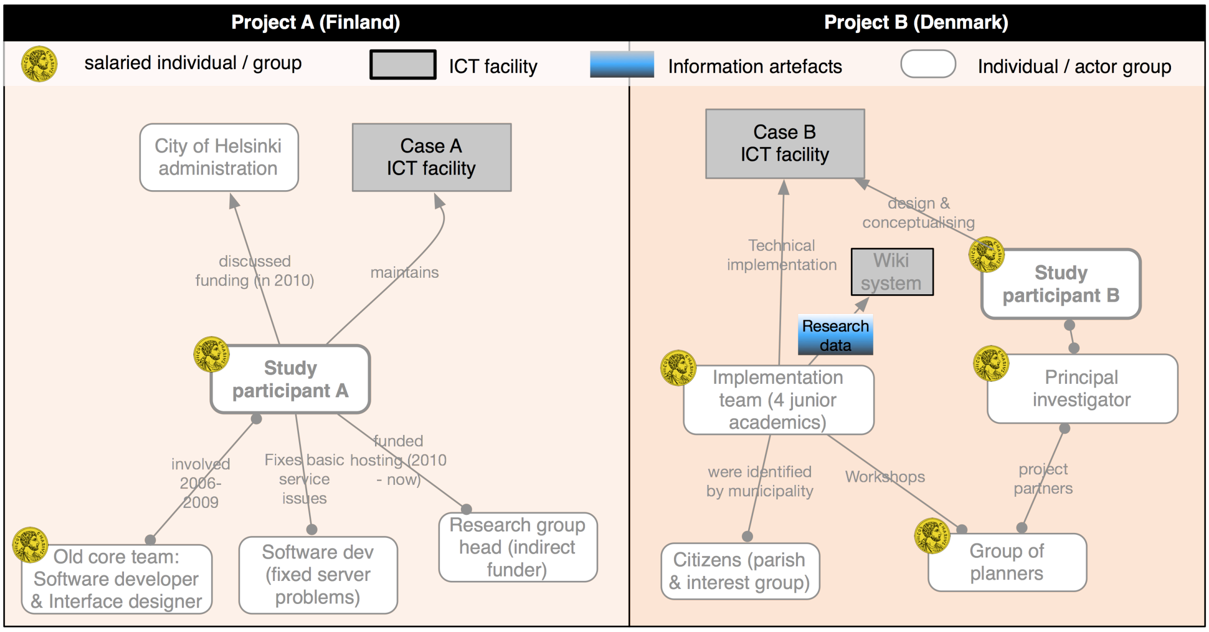


Figure 26: Actors at the collective choice level (core organisers = study participants in bold)

On this level, core organisers[135] were small teams, comprised of skilled full-time academics contractually tied to collaboration partners and funders. The teams included the two study participants (participant A and participant B). These individuals made decisions on the design and technical functionalities offered. They were in charge of implementing the ICT facility and, as academics, spent time on "conceptualising" what the new technical capabilities meant for new forms of citizen participation in urban planning.

---

[134] I accept some conceptual ambiguity to alternate terms, such as "platform", "app", "ICT facility", "tool".

[135] This is adapted from Crowston (2011) who described 'core developers' in FLOSS projects as being those who "contribute most of the code and oversee the design and evolution of the project".

For both study participants, developing a technology that could support new forms of participation provided a steep learning curve in working with partner organisations, community groups and political institutions. In both cases, functioning ICT facilities were co-developed. Later on, study participants were involved in decisions on the future maintenance of their technologies. In case A, it let to the continued availability of the prototype online at which point it entered a ‘maintenance’ phase. At the time of the research interviews, each participant reported that their team of co-organisers had used up their academic grant funding and both study participants had moved on from the projects and the resulting ICT facilities.

We will concentrate on two pertinent issues that were mentioned by both study participants, the financial aspect to running the technical infrastructure and the challenge to establish relevance for technical intervention within the existing institutional context.

7.5.1.1 Funding ICT design and maintenance

Changes at the code level have the capacity to introduce new functions and are time and resource intensive, but are necessary to respond to changing requirements over time. Funding allowed the organisers to be responsive to needs arising from the embedding of technology in new social contexts and matching it to institutional arrangements. Thus, funding was essential for facing challenges related to maintaining the ICT facilities. Through the interviews somewhat (dis)similar trajectories and outcomes could be established related to the availability of funding.

While the Finnish case (project A) ran over a considerably longer timespan (2007 - 2013), the interviewee expressed that funding for changes at the “code level” stopped midway in 2009. This resulted in the departure of most of the salaried researchers capable of implementing them. Hence at the time of the traffic safety sub-case (see section 7.5.2), no further adaptations could be made to the ICT facility, hence interactions on this level concentrated largely on keeping the platform accessible online. As the interviewee for this project (project A) noted “*myself and my superiors [...] in charge of the budget [...], we discussed it often - OK, what should we do [...] It was a bit unclear how (the geospatial platform) should continue and maybe I ended up being the only one who really needed it, because I was doing my doctoral thesis about it. [...] it was difficult for them [...] to frame it in a way to get more academic funding*”.

The study participant for Project B reported an intense phase of participatory design in which planners and citizens alike contributed to the development of a final functional prototype of a mobile and web application. A transition from a design phase to a ‘maintenance’ phase was less noticeable. While the ‘funding’ members of the original team left, the prototype of the ICT facility was being re-adapted to a park planning case by study participant B. This shift in resources was crucial to the prototype's further technical evolution. Initially there was interest by a commercial partner involved in the project to translate the prototype into a workable commercial product, but "*the goal was not to design a product and get it into use, it was about exploring new possibilities and getting a theoretical and conceptual understanding of what can be done in that domain*".

To enable a continuation of the spread of the ICT facility prototype, the core organiser in case A decided to make the software (code) open-source for further adaptation by volunteers online. Additionally, the organiser secured some support from their respective academic institution to fund on-going hosting costs through an internal research budget and draw on a capable ICT specialist to volunteer some support time.

7.5.1.2 Instilling ownership and finding a home for the ICT

Both study participants acknowledged that the question of sustaining their ICT facility resulted in internal debate. Without additional funding sources, the development teams were unable to dedicate time beyond the initial grant period. It became necessary to find a new home for the ICT facility so that it could be accessible to others in the future. This issue demanded a consideration of the existing political institutions, large organisational users and affiliated funders that originally took part in the development of each ICT facility.

Regarding the established institutions, the existing political institutions rejected the ICT facility in case A partly because they had a different understanding of the scope of citizen participation: the study participant for project A noted "*You see, in the City of Helsinki participation is still understood as that initiated by the officials. They open it up. They open up the possibility for citizens to participate. Participation is not citizens starting something. I think it is cultural. It is a cultural thing in the institution. It is very hard to integrate this bottom-up or citizen driven thing to the way the institution is organised. [...] It might go in that way, but especially at that time (2010) it was way too early* ". This shows that the technologies occasion the opportunity for new institutional practices, but often it is difficult to counter the institutional inertia. The challenges can be described as "institutional blockage" in which the functionalities of the ICT facility remained rather separate from established institutional practices.

While the ICT facility in Project B was applied in a social context other than where it was originally developed, similar issues existed. For example, the study participant for Project B reported that "*on the planner's side there was a lot of concern [as to] what they would do with all these comments and all these photos and how that would help them*". Again it seemed that the existing political institution was as yet unprepared for a reframing of its understanding of participation. The project had a bias towards the everyday citizen but, as with project A, planners were the important decision makers and influencers for the design. Important linkages with the established institution's ICTs were in the end possibly too difficult to achieve — both technically (for example the realisation of 3D objects for augmented reality) as well as institutionally.

7.5.1.3 Challenges at the collective choice level

Institutional and technical challenges mentioned by the study participants are summarised in Table 12. Overall, finding a sustainable model of operation for the ICT facility was a key issue[136]. Common to the cases was the dilemma that each technology was faced with finding a home beyond the "confines" of academia. The issue was largely avoided by Project B, while core organisers in case A followed a strategy of open-sourcing the code for the technology in the hope of attracting third party developers. Technical challenges recurring in each case were the difficulty of linking the new technical opportunities with the existing institutional practices. It is desirable to support new forms of participation institutionally, such as self-organising behaviour in community groups. This points to the recognition that ICT application is about "organisational development" that needs to be considered alongside the technical intervention (Rattray 2006).

	Project A (Finland)	Project B (Denmark)
Institutional challenges	• Sustaining the infrastructure: lack of consideration for future viability. Start-up investment might have made sense. • Finding a home: did not blend with authority's processes - "Participation is not citizens starting something. […] It is a cultural thing in the institution. It is very hard to integrate this bottom-up or citizen driven thing to the way the institution is organised."	• Getting time: "There is always this problem […] getting time and enticing (planners) to take part, but […] to accommodate that we drove over there several times and involved them in […] design activities." • Avoidance of institution: "The only time framework we were working with were conference deadlines [...] and the overall research project[…]. In the (first stage) it did not plug into any ongoing activities (by planners"
Technical challenges	• Usability: "It was not polished so that people could use all the features fully. […] Some of the features […] needed explanation." • Documentation: "To survive as open source code, it should have been documented much better and it should have been much clearer and easier to use." • Funding upgrades and keeping with the times: As of 2014, the coding was 'old' and it would have needed to be reprogrammed.	• Access to user-generated data: on the (authority's) side (was) […] concern of what (to) do with all these comments and photos => there was a citizen bias: "we were concerns of how they work […] but it was not that we had to interface with any technical infrastructure on their side. • ICT literacy and data access: "it was […] this plain problem who has smartphones and who has a data plan and who has data connectivity and these are not so densely populated areas."

Table 12: Challenges identified on the collective choice level

[136] We recognise that commercialisation or adaptation into a scalable software product was not the main goal of the core organisers.

7.5.2 Making operational choices – embedding new forms of participation with community groups

On the operational level, the analysis shifts to the efforts of embedding the ICT facility in the practices of community groups, their often informal social organisation, and technologies in use to make the new form of participation real to the public[137]. Project A offered the ability to collaboratively annotate a geographic area by dropping comments on a digital map. Similarly, in Project B, citizens could drop comments and other media to geographic locations using their mobile phones[138].

The actor networks have been partially mapped in Figure 27 based on actors mentioned in the two interviews. Linkages between actors on both levels emerge that show how outcomes at the collective choice level (see section 7.5.1) influence the technological capacities accessible to the citizen groups in each sub case (e.g. traffic safety planning & park planning).

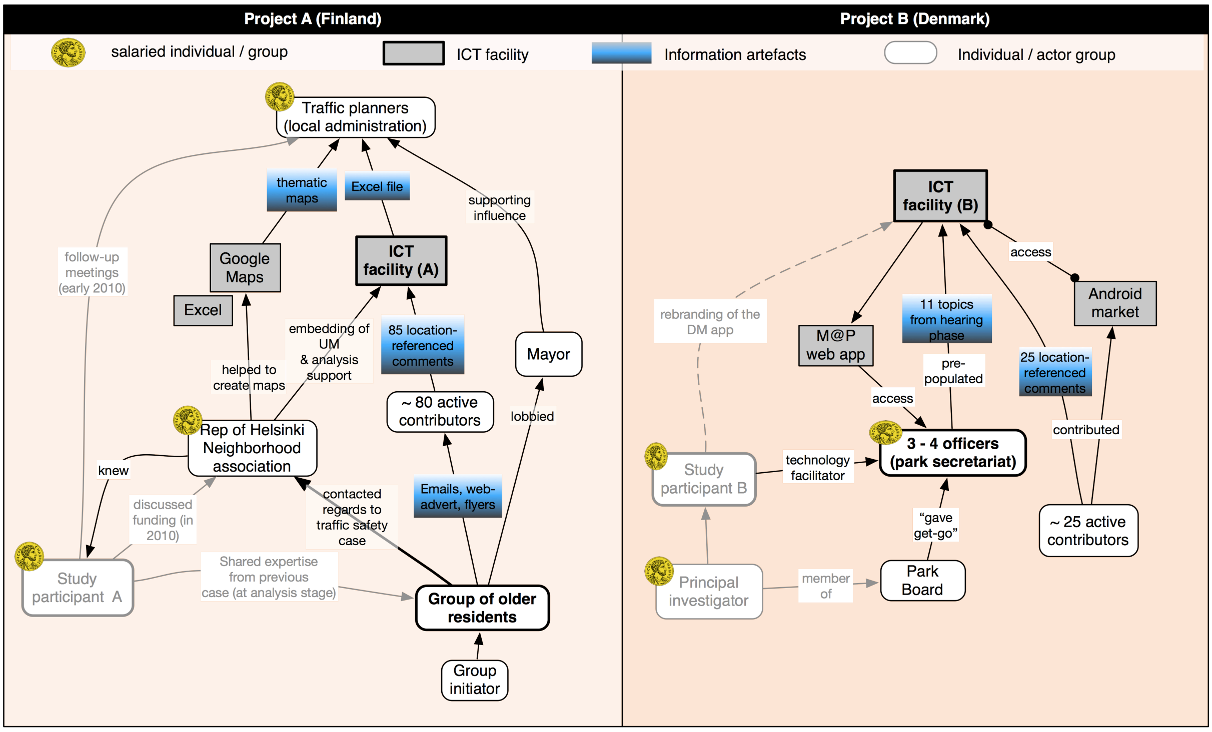


Figure 27: Actors at the operational level (core organisers in bold)

---

[137] This required consideration of space as the socio-cultural infrastructure for the different individuals and group actors.

[138] Note that additional modes for citizens to partake were envisioned as the researchers had a richer conceptualisation of the possible interaction with each ICT facility for future iterations.

The institutional arrangements in these cases were informal (particularly in the subcase for Project A). Core organisers were individuals that implemented and led a participation initiative and sought to take ownership of the technological intervention towards their goals. In Project A, this was a group of elderly volunteers that sought to influence municipal planning. In Project B, it involved the administrative members of a park secretariat that sought to shape their park plan.

The two study participants were technology stewards to these groups with varying degrees of involvement. At the time (2010), the study participant for Project A was already out of funding and her involvement in supporting the community group was rather hands-off as she said "*I have made decisions in terms of which cases I was involved in and how much help I could provide to people using the UM and how much effort I would put in [...] facilitating stuff, if things are not working.*" She noted that she only got involved at a late stage when the citizens had already started analysing data collected through the ICT facility. Conversely, the study participant for Project B reported to have been deeply involved in customising the ICT facility to make it fit the call for participation of the park administration.

7.5.2.1 Ownership by the community group

In both projects, online provision of the technology facilitated a differentiation in maintenance of the technical infrastructure (that was overseen by the interviewees) and the use of the platform (by the community groups). At the operational level, ownership is an important question. It asks who is organising the use of the technological intervention *locally*. Ownership describes the core organisers in each action arena. It pointed towards other important parallels that emerged as key challenges in each case: that of communicating the new form of interaction (see section 7.5.2.2), and the importance of 'adaptive design'; and who would take responsibility for each.

Pronounced community self-organisation was evident in the traffic safety sub-case (Project A). The interviewee mentioned notable citizen-to-citizen and citizen-to-planners interactions (see Figure 27) that initiated a unique cause. A grandfather, worried for his grandson's safety on the roads in the neighbourhood, served as inspiration for the citizen group. Using the ICT facility in Project A, they collected 85 location-referenced comments from fellow citizens who became active contributors by adding comments or media files related to traffic safety to the map provided within the ICT facility. Together with the representatives of a city-wide neighbourhood support organisation serving as technology facilitators to "enable things to happen", the members of the group analysed the information collected themselves and produced an outcome report that even involved the municipal planners responsible for their area who informed the group of issues that were already in the pipeline but as yet unprocessed.

In the subcase of project B, the core organisers for the Danish park planning case was a park secretariat, who had the legal responsibility to involve citizens in developing a new local area plan. They wanted to try something new and were interested in the prospect of learning about mobile applications. Unlike Project A, study participant B’s involvement here might have been supported by the lead researcher membership on the board of the park. Since there was a higher degree of interest on behalf of study participant A to test out the technical intervention in a new context and equipped with some funding for adapting the ICT facility to the park group, here it is harder to tell who the core organiser was. Since the interviewee for Project B got involved in adapting the ICT facility to this organisation's needs and conducted some of the participation events, he emerged as a core organiser alongside the park secretariat.

While in the case of Project A, the community group had the clear goal of influencing the planners and largely worked on its own terms, in Project B, the park secretariat seemed like an established institution with an approach to citizen participation that can otherwise be described as top-down. Hence, the two cases exhibited differences in the local groups capacity to self-organise the use of the geospatial technology. We will continue this investigation in further thematic sections.

7.5.2.2 Embedding the ICT facility with community organisations

To transform the technical intervention into a valid, trusted form for participation, a key theme in the operational choice level was the embedding of the ICT facility with community groups. This embedding required the consideration of pre-existing forms of organising, other ICTs in use and the respective physical context (further discussed in section 7.5.2.3). To fit the context of the community group in each case, the researchers reported fitting the ICT facility to the participation initiative.

In the traffic safety case in Project A, a popular website of a local neighbourhood group was used to advertise the ICT facility along with a call for participation. The community group sent targeted e-mails to known activist lists, and distributed flyers. In addition, they began working with two traffic planners responsible for their neighbourhood, for whom traffic safety was a shared matter of concern. When data was collected via the ICT facility in Project A and analysed by the community group, the resulting outcome report and a number of thematic maps were uploaded to the local neighbourhood website to share the outcomes with citizens who became involved. An external expert, who helped the group to set up the ICT facility, open a shared mailing account and an account for Google Maps. This created an appropriate technological infrastructure for communication to the group organisers. At the time, no further funding was available to make code-level changes to the ICT facility. Hence, the tool was used to produce tabular data exports in Excel and facilitate a range of freely available tools to analyse and process the data coming from the platform.

In Project B, the 'embedding' activities were prominent. Here researchers organised several meetings with the core organisers (the park secretariat) to establish how the technical augmentation of the existing planning process could be done. At the time, the researcher's ICT facility was not freely available on the Internet. According to the interviewee, "deep integration" within the participation initiative became a concern. The outcome was a re-branded, bug-fixed, steam-lined mobile app to "make the tool more meaningful to citizens in the way that would help them connect better with what was going on in the tool" (by adding locative QR-codes). They then used a popular festival to "jump start the application" and to "try out the app with citizens and visitors". However, despite regular meetings with the secretariat, newspaper articles "about the festival and about their tent and about our application" and newsletters to other organisations in the park, the study participant for Project B reported challenges in embedding the ICT facility within the actual participation initiative. Although 2000 individuals visited the booth during the time of the festival, the application only garnered 30 comments, partly because it was perceived a separate initiative. The technical facilitator for Project B reflected that they should have attempted gaining more 'enrolled use' by networking with local organisations in advance, which would have called for more work to reach individuals and groups on a one-to-one basis. The citizen contributions were made accessible to the secretariat of the park via a web interface so that they could "follow up on what was happening", but there was no evidence that the park organisers used the web portal. This highlights that the tool was probably disconnected from this community-based organisation.

7.5.2.3 The influence of the local physical context

To encourage voluntary participation, most community-based geospatial technologies take the local physical context as a source of common reference points. Physical space is a socio-cultural infrastructure to interactions between humans that should be enhanced in the application of technical infrastructures (Dourish and Bell 2007). ICT facility in each project had a geospatial focus. Hence, the properties of the geography where the tools were applied had an influence on the embedding of the platform into meaningful participation.

In Project A, traffic safety was of great relevance to a fairly well defined local area and its local population. Additionally, the core-organisers, the local community group, were well connected to other local decision makers and lived in an environment in which the traffic issue was well supported by the local population.

In Project B, this was set in a multi-place and largely open terrain (a national park). Here the technical intervention was challenged to garner participation by visitors and permanent residents in a large and sparsely populated area. The park's high visitor count and relatively low number of local residents made it additionally difficult to garner participation. While the study participant's main interest was in "interlinking between physical places in the park and what goes on in the application" this was apparently challenged by the vast and sparsely populated target area. The advertisement of the application at a local harvest festival may have appeared as a good idea, but in practice meant that the location for intended citizen participation was in dissonance with the location where the interaction capabilities were advertised because of network connectivity issues, which meant that the technology-supported mode of participation via a mobile phone was impractical.

7.5.2.4 Challenges at the operational choice level

In these two sub-cases, study participants illustrated the challenges involved in embedding the ICT facility in an on-going call for voluntary participation. This involved considering the existing digital technologies, the mode by which these two exemplar groups organised, and their capacities to communicate and analyse information that could be transformed into collective outcomes that are useful for the community's purposes. Ideally they would set their own rules and terms of organising participation.

Table 13 summarises the aforementioned challenges in somewhat more detail as per interviewees' comments. A desire by the community group to influence the planners in the established institution was evident in Project A and thus the terms of such cooperation emerged as a challenge. It showed that an open call for participants was an important criterion for overcoming any challenges from established institutions ("low barriers to participation") in which each case indicated evidence of a clash with the institutional practices of these actors ("clash with authority's systems").

	Project A (Finland)	Project B (Denmark)
Institutional challenges	• Ambiguous terms of cooperation: "At an institutional level it is not yet articulated or clear to what degree planners should collaborate with citizens." So far the only thing that is institutionalised is that it is important to share the plan. • Provisioning low barriers to participation: in the sub case, planners at the authority appreciated that the tool had been available for all to participate. • Embedding: considering ICT facility in use (e.g. community website) and consideration of the physical context	• Legal requirements: "They had to have their lawful way of getting proposals. […] You would have (to) step outside and write a short notice […] they could receive it in text form, in an email, or whatever, but not through our app." • Requires interest by established institution: "willingness on behalf of organisation" - there was an incentive to try something new • Embedding: inter-linking of physical activity in the park and the information infrastructure for "deep integration" which required working to a tight time schedule (set by the institution)
Technical challenges	• Clash with authority's systems: Authorities did not imagine that citizen feedback could come in a format other city council email & online form (i.e. in a CSV file). • Low-cost adaptive design: Without funding, development could not occur: "instead of going via Google Maps, we could have had a button to export a map for the tags […] So we went through Google Maps but it could have been a feature of the (platform)"	• Clash with core-organisers' systems: There were questions how the park could follow up on comments. "how do you actually involve the people who oversee the process?" & "how do you get content in and out of the app?" • Orchestration rather than integration: "they just need to have an overview and pull things together and have it as a […] channel that feeds into their planning processes."

Table 13: Challenges identified on the operational choice level

7.6 Using geospatial technologies 'bottom-up'

The case comparison highlights that embedding forms of participation in planning is a complex undertaking for the multiple social contexts, application sites and technologies involved. The interviews indicated many factors why some of the previous geospatial applications might have failed to step beyond temporary interventions as institutions and community groups failed to take ownership of the technological possibilities. Few have come close to the vision of bottom-up networked publics (Bruns 2008) or self-organisation by community groups (Boonstra and Boelens 2011).

While the deployment through the Internet helps to detach use from maintenance of the technical interventions, both the collective choice and the operational choice levels hold different and occasionally competing challenges that may prevent the adoption of the new forms of participation as established practice. The cases illustrated two important challenges. First, the challenge for 'local' group and individual actors to make any such advanced platforms their own and part of their decision making and data management needs. Second, the cases demonstrated the challenge of finding a suitable model of maintenance of the underlying infrastructure, which draws in funding and attracts collaborators to the action arenas in which decisions on the maintenance of the ICT facility are made.

7.6.1 Institutional challenges

Institutional challenges described frictions relating to established 'rules' of interaction within formal but also informal organisations. Beyond the inertia of existing practice, in established institutions (such as municipal government) legal requirements apply that prescribe practices of citizen participation. On the other hand, informal community groups develop practices of organising that may become habitual over time (contributing to new institutions).

On the operational level, Project A gave planners an indication of what could be achieved by taking advantage of the novel technical opportunities. Planners at the established institution appreciated that the community group facilitated a process that was open to anybody — a key legal requirement for participation activities by planners. However, had the paid-for community engagement representative been unavailable to support the local community group, the case would probably have been less successful. While the technical platform enabled collection and mapping of feedback, categorisation of output and export to a CSV file for further analysis, the additional professional support was highly important in subsequent data analysis and report writing.

Nevertheless, the practices of the political institution barred it from hosting the ICT facility as it lacked control of citizen initiatives that anybody could start. Self-organisation on a specific matter of concern by community groups thus requires consideration of the existing political institution(s) that the community group intends to influence and the negotiation of shared ownership models. Likewise, as shown in Project B, supporting community groups through a participatory platform provided and possibly controlled by the municipality would require the instillation of a level of ownership over processes, techniques and data, particularly if strongly related to the physical context they are embedded in to be successful.

The analysis suggests that established (political) institutions need to be closely considered in two ways. On the operational level, to understand how the community group and other informal organisations may influence these actors from the bottom up (as shown by Project A in which the core organisers shared expertise with the community group from comparable past projects). On the collective choice level (so as a task for core organisers for technical interventions), to link and embed the ICT facility and associated new forms of participation within these existing institutions, their practices and technologies. Here interventions seem to be constrained as the technical intervention gets caught up in dilemmas of conflicting responsibilities, ownerships and interests (see for example case A).

Likewise, technical interventions depend on the active and continuous use by the community groups, and hence ICT facilities developed require a thorough design approach to become embedded within these informal groups and their practices. Since their needs, concerns, permanence[139] and rules of organising are highly variable, this may be addressed by compartmentalising infrastructures into various software deployments linked by common standards; as well as the compartmentalisation of ownership over information. This is a challenge for designers, as they may learn the challenge of diversity first hand: in a planning context, citizen groups remained poorly conceptualised, due to their many competing agendas (Falleth and Hansen 2011). This calls for platforms that are easy to use, possibly centrally maintained, but still offer ownership of information assets that can be controlled de-centrally by community groups.

7.6.2 Technical challenges

Technical challenges describe barriers stemming from the various ICTs already found across the various social contexts addressed here. The literature review found for example barriers such as incompatible technologies, costs associated with supporting many interfaces and data security (Rattray 2006). Technical challenges create complexity as they require dedicated individuals knowledgeable enough to overcome those issues, which is one of the factors that complicate deployment of GIS technologies within community groups (Leitner et al. 2002). For each subcase the ICT facility would need to be embedded in consideration of the other technical devices that surround it. Working with something as complicated as geospatial technology appears to become technologically easier as the Internet enables widespread deployment as shown in both cases presented here.

Across the two levels of the analysis, the study has shown the concerns core organisers grapple with (here academics setting up ICT facilities for new forms of participation) beyond the community groups that may eventually employ them. In case A, the output generated by the community group clashed with the way in which the existing institution's archival system was traditionally consuming information - one contribution by one citizen at a time. On the other hand, the community group showed an ability to generate complex outputs (thematic maps, joint report) based on citizens' input that they collected themselves. In Project B, while such bottom-up participation failed to be clearly

[139] This relates to the degree of formalisation of the group and the concern they cater for. For example, parish councils and the park secretariat (that are a rather formal type of community organisation) are formally organised and recognised whereas the informal group that built around the traffic safety case was not.

identifiable, there were the challenges of integrating the ICT facility's use into the institution's existing processes. In this case, the core organiser for the ICT facility contributed much additional time and effort to 'deeply integrate[140]' the technology to its context, engaging in thorough 'adaptive design' (Saad-Sulonen 2012) although in the end that did not make a difference as far as the adoption of the system by all stakeholders was concerned.

7.6.3 The technologist's role

It might be argued that researchers' purpose is not to develop lasting and workable technical interventions but rather to rely on pushing the boundaries of existing technical set-ups and preconceptions of established forms of organisation. Nevertheless, researchers in both cases believed in the potential for long-term deployment and it is therefore unfortunate to see their interventions falter.

Certainly both interventions made other valuable contributions, such as building networks and knowledge amongst those involved. Given the accounts of practices observed, the cases articulated the need for strong and intensive engagement with the rules of interactions of all involved user groups. Across multiple social contexts and physical settings this fast approaches the technology facilitator's own resources and hence a focus on one locality, institution or community may be advisable. By doing so, the objective is to distribute the ownership over the technical interventions amongst them for example by compartmentalising the user management features of the technology so that this is achieved or, if this is not possible, to focus on interoperability standards.

7.7 Conclusion

This article focused on the barriers to embedding new forms of participation into existing (institutional) processes by analysing the experiences of two technology facilitators. By linking collective-choice with operational action arenas, the institutional analysis helped to ask the important questions of how, why, and in which context different actors got involved (institutional aspects). It differentiates two levels of analysis, maintenance and use, which are equally important in maintaining new forms of participation.

[140] Based on our findings, this included the consideration of the technological and institutional context. Compatibility, usability and visual design of the intervention are technical aspects. Timing with the organisation's participation initiative, the decision making practices and resourcing are institutional aspects.

While both cases exhibited different stages of development in the lifecycle of the ICT facility, the challenge was the embedding of the technology within existing practices. Embedding the ICT facilities in a real context offered opportunities to shape the technology to the social context[141]. The research has shown how important it was to plan ahead and build a 'home' for the ICT facility so that it could be sustainable in the long-term by attracting further use and funding. In both cases, this was difficult to achieve because no host organisation with sufficient resources was interested to host the technological intervention.

Provisioning access to the ICT facilities that offered new forms of participation described in this article makes it necessary to overcome many dilemmas by navigating both complex technical and institutional contexts on several levels of governance. In the two cases presented here, success was largely dependent on external support helping these groups deliver the new forms of participation, and embedding those within the participation initiative and the existing technologies used, as well as the local physical context. Both cases have shown that these community groups were involved in a complex set of institutional arrangements. These groups evolved their own decision-making structures and attempted to influence existing political institutions.

7.7.1 Research limitations and future work

While comparative case studies are useful to learn from outcomes reached under different study conditions, three limitations underlie this study opening opportunities for future work. First, additional data for examples from archival records and even the technological prototypes themselves were discarded but could be used in future in-depth studies. Second, the analysis was performed by a single skilled analyst and thus contains his knowledgeable interpretations of the interviewees' responses. Third, the analysis of the two experts' experiences was limited to their point of view. An account of other actors involved including planners and community groups was impossible.

Future studies could focus on the experience of 'bottom-up' actors, such as community groups' combined use of ICTs, their organisational set-up, and collective goals. This should document the types of data community groups maintain and how information is shared with established political institutions. Future studies could consider archival data such as transaction logs from ICT in use. Using ICT beyond 'temporary interventions', future studies could follow the embedding of the technical intervention and document

---

[141] This reflects Bødker's notion that every interaction with ICT should also be seen as a (re)design of the ICT.

how institutional practices changed in response to citizen-contributed data towards more self-organisation or local autonomy by community groups into consideration.

TRANSITION

Having considered patterns of participation in an existing planning process (in CHAPTER 5 and CHAPTER 6) and evidence of the challenges for establishing new forms of participation within urban planning contexts (CHAPTER 7), I have shown the importance of understanding the institutional and spatial configurations in determining sustainable thinking about 'finding a home' for the technical interventions and the associated incumbent new form of interaction. This argument follows on from Yvonne Roger's call for computer scientists to follow compelling stories of possible future social practices over technology-driven propositions. Combined, the past three articles have hopefully highlighted to you, the reader, that the technical interventions in urban spaces undertaken under the umbrella of 'urban informatics' are heavily politically contested. There are demands towards accessibility, distribution of that accessibility across communities across very different material contexts and spatial configurations, and the 'need for speed' in the planning process that may cause inertia in the adoption of new forms of interaction.

Looking back, more than in the work place context, technical interventions that seek to enhance various actors in society to collaborate and coordinate their actions more easily and efficiently, the underlying question of who gains and who loses, who partakes how, with whom and how cannot be ignored. Changing established practices of planners can easily be perceived as a substantial burden given the many other competing commitments that their day-to-day work demands. As a technologist intervening in such contexts it is crucial to establish a substantial awareness of the present political agendas, needs, and concerns of the various actors as it is to appreciate the pre-existing technical set-up provided within a social context. This further implies the need to consider existing institutional practices even in developing technological infrastructures which seek to challenge the status quo.

The real challenge however is in linking needs for systematisation and coordination for planners with that of the varying speeds of development, institutional practices, needs, aspirations, and values of the various groups (or 'civics') that planners naturally interface with. In a very different context, Amin (2014) found that the influence of infrastructure on the disadvantaged in Brazilian favelas was mediated by (1) procedures, court activities between land owners, government, settlers; (2) changing political landscape and shifting policy priorities, sometimes with favelas sometimes against; (3) lastly the balance of power between those within the favela (NGOs, religious groups, community organisations) and those outside, including local government. I think that there are similar concerns for the provision of ownership over planning processes for non-expert community groups in the planning system in the cases studied here. Amin's insights lead to a sobering view on the capacity of local actors to organise and support change for themselves and within established institutional processes and beyond. Community organisation and activism demands substantial dedication, care and nurturing of its cause. Given these competitive constraints it seems sensible to find a good middle ground between devolution of responsibilities to various civic groups and the provision and support established actors, including planners, may be able to provide.

The next, and final chapter will discuss and summarise conclusions to this thesis.

CHAPTER 8

CONCLUSION — CONSIDERATIONS FOR NEW FORMS OF PARTICIPATION IN URBAN PLANNING

"The power of infrastructures is their ability to reconfigure the relationship between local and global. The power of pervasive computing, then, lies too in this relationship, and in the ability to transform it." (Dourish and Bell 2007, p. 427)

8.1 Introduction

In the governance of citizen-generated media, Graham (2004) called for a spatial turn in studies of digital infrastructures. De Lange and de Waal. (2013) used the concept of 'ownership' to indicate an inclusivity of citizens to take charge of matters of their concern and related it to the adoption of digital infrastructures. Studies should avoid considering information communication technologies (ICTs) in general terms and instead appreciate the existence of vastly different user groups, temporalities, and the fact that any citizen is geographically located somewhere in the real world. As ever more information is created online, this observation led Weise et al. (2012) to take the position that future information infrastructures need "to feature a sensibility for local control[142]." Therefore, the empirical studies in this thesis were guided by the ambiguity in how different actors (such as public authorities, private entities, and citizens) establish and make use of various information communication technologies (ICTs) in combination to augment, shape, and generate agreements about physical spaces for a common social purpose.

Real-time data from a city's infrastructures, embedded within urban spaces, present opportunities to gain a detailed understanding of urban change dynamics across time and space[143] (Ratti et al. 2006). Clever use of these data streams could, for example, complement "traditional city council surveys" and enable new forms of "ad hoc action" by

[142] This claim was made at the outset of this study. Studies in this work enable me to critique my own work.

[143] For example, the literature review mentioned four projects that generated detailed activity plots of commuting patterns using a range of data sources, such as geo-located social media posts, taxicabs, or mobile phones.

citizens[144] (Ratti et al. 2006, p. 740). Despite the strong uptake of social media, it remains less clear how technologists and city officials can step beyond mechanistic visions of digital infrastructures such as automated systems, that work through a sense-compute-actuate process, in which citizens may be employed as a "human sensor" (see CHAPTER 3)(Weise, Hardy, Agarwal, Coulton, Friday and Chiasson 2012a). Instead, they should gain an understanding of the *organisation* of forms of participation in and with the urban space, that are citizen-centric in their design and use. This calls for revised institutional processes that could support self-organisation by citizens around resolving specific urban problems that are of concern to them (Boonstra and Boelens 2011).

In this thesis, spatial context is always important to the fact that this is about planning for what happens in a space, but also in the sense that people occupy particular spaces and physical settings which affect their ability to take up (or not) the technologies meant to dissolve spatial differences. De Lange et al. and de Waal (2013, p. 1) noted "the city has become a hybrid of the physical and the digital". The imbrication of space in and with social relations was seen as an important context for the design of computing systems (Dourish and Bell 2007). The "material and physical circumstances" are important and cannot be viewed as a "passive physical container" for ICT application. Hence, the thesis took inspiration from studies in participatory geospatial technologies, that sought to support participation through collaborative mapping (Kingston et al. 2000; McCall and Dunn 2012; Talen 2000).

The literature review (CHAPTER 2) established gaps between disciplinary areas, for example between research on planning support systems (PSS)[145] in urban planning and citizen-centric geospatial services developed in computer science disciplines. Much work is still to be done on the interface(s) between the public administration and the various local community groups involved in shared matters of concern (Bødker and Zander 2015). In practice, it has been less clear how technical systems (for example participatory geographic information systems) can benefit, for example, both the citizen and the more experienced municipal planner as the expert representative within the established

[144] In this thesis, new forms of participation were associated with technology-supported collaborative interactions such as crowd-sourcing (Brabham 2008) and commons-based peer production (Benkler 2007). In urban planning, new forms of participation could enable ad-hoc and brief cross-participant interaction, in real-time, on a large scale, and across different physical contexts (see (Nuojua 2010; Bohøj et al. 2011)).

[145] Traditionally the development lineage of geographic information systems (GIS) is also strongly interwoven with the professional planning discipline. Even participatory planning GIS's were critiqued as being 'technicist' in approach (Talen 2000).

institution (Bugs 2012). Thus, this thesis investigated **what existing and emergent social practices in urban planning indicate institutional and technical reforms suitable for new forms of participation**.

This concluding chapter consists of four sections. First, it will recap the empirical investigations conducted in response to the main research question. The operational research questions of these articles are reiterated here and findings discussed accordingly. Second, it will synthesise implications for planners (as representatives of established institutions), community groups (as representatives of local actors enmeshed in the material contexts of with proximity to the matters of concern to urban planning), and designers of human computer interactionists (as representatives of technical audiences)are provided. Third, the discussion steps back to reflect and critique the opportunity to 'localise' urban data and parts of digital infrastructures within local actors. Finally, the chapter provides an overall conclusion and suggestions for future work.

8.1.1 Review of the case studies

To develop an understanding of considerations for new forms of participation in urban planning, this thesis has drawn on two embedded case studies (see Figure 28). The institutional analysis methodology emphasised the role of institutions, understood as the habitual practices of organising within a particular social context[146]. The goal was to synthesise the diverse perspectives in the establishment of broad system level conclusions. Thus, the contribution to the literature occurred at a level that sits above the experiences and practices of the twenty-three individual study participants involved across the two cases as it focused on system-level configurations of governance.

[146] Importantly, this view assumes that local actors, including groups such as civic societies, town councils, parish meetings also exhibit forms of institution.

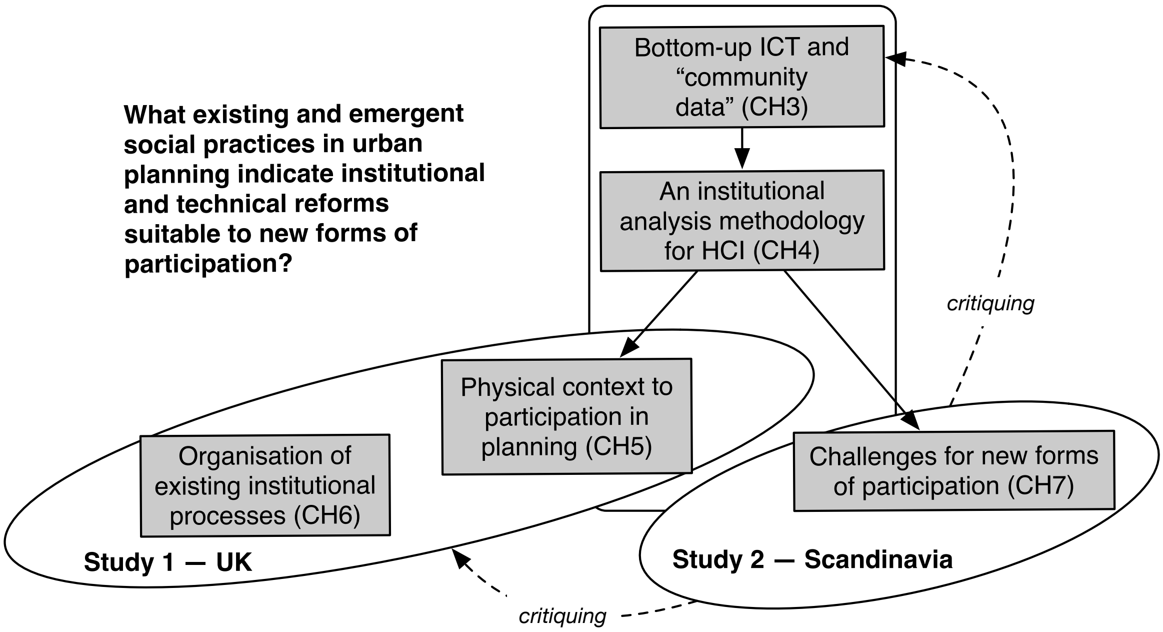


Figure 28: Thesis chapters that contribute to answering the main thesis question

A first study, dubbed "PlaceChangers", looked into the established forms of citizen participation in urban planning in Lancaster (UK) to understand the patterns of interaction across ICT facilities, information, and various organisational and non-organisational participants in Lancaster (UK). The study analysed the ordinary practices of citizen engagement in spatial planning based on archival data[147] and process-retrospective interviews (Langley 2009) involving twenty-one study participants. The participants were chosen to reflect the diversity of key participants involved (both planners as the organisers and a range of Lancastrian and non-Lancastrian contributors). This case study of existing practice enabled the empirical analysis of the role of the physical space to citizen participation based on existing archival data. Furthermore, it made possible analysis of equality dilemmas in organising complex long-term participation processes over time.

A second study analysed two technical interventions within existing institutional processes in Scandinavia (Denmark and Finland), a region known for its firm stance on participation in the design of socio-technical systems (Mumford 2006). The study was based on the experiences of two experts, who co-designed, developed, and implemented technological platforms[148] for new forms of participation. The goal was to establish challenges for technology-supported forms of participation in spatial planning that would

[147] The archival data that documented 2100 instances of participation of 600 citizens across four phases of participation that were organised by a team of urban planners.

[148] They employed geospatial platforms to facilitate citizen self-organisation.

inevitably require an adaptation of planners' institutional practices and technological infrastructure. By involving two experts, the study complemented the analysis of the current processes (study 1) through an insight into the challenges of undertaking new forms of participation through technical interventions.

Together, the two planning cases mirror the challenges in embedding digital infrastructures in mediating decisions on spatial outcomes and, in consequence, the necessary institutional and technical reforms. For that, urban planning presents itself as a formal process to control urban development, which means any changes in the physical environment of cities.

8.2 Empirical findings per chapter

In the next section, the findings of the three empirical chapters have been grouped according to their themes, the role of the physical space in participation in urban planning, existing institutional processes of participation, and finally the challenges faced by new forms of participation in planning. The following section answers the main research question[149] by drawing broad considerations as they apply to different participant groups.

8.2.1 The role of physical space

CHAPTER 5 pointed out that the physical context[150] of the act of *citizen participation* in urban planning has received too little attention from researchers and practitioners in urban planning. Hence the operational research question asked: Which patterns of interaction become apparent amongst participants in spatial planning? What patterns of participation occur in relation to places?

By geo-parsing citizens' location and the places they commented on within two online consultations, the analysis demonstrated that the data from existing planning processes offers the capacity to articulate and represent spatial relations that exist in established forms of participation (such as in online consultations). The geographic focus in this dataset is the District of Lancaster, a semi-rural municipality in the North West of the UK. In the analysis, a number of neighbouring villages emerged as rich in local citizen activism as indicated by a cluster of local citizen participants that commented on local places. On average local indigenous commentators were approximately 1.9 kilometres

[149] E.g. What existing and emergent social practices in urban planning indicate institutional and technical reforms suitable to new forms of participation?

[150] That referred to the placement of actors and 'issues' they cared about in a space.

away from the places that were the matters that concerned them in their comments. Further, the analysis concluded that local contributors had a lower chance of success in influencing planners' decisions than participants from afar.

At least for semi-rural areas that include settlements distributed across a large hinterland, the discovery of activity clusters suggests the opportunity for revised institutions based on greater autonomy of existing informal groups at different physical locations. Interviews with municipal planners confirmed the existence of vocal 'neighbourhoods'. One finding was the poor support for these local differences in the technical infrastructure used within participation activities as far as the representation of consultation data goes, but it can be extended to the institutional arrangements that put the planners at the centre of this information ecology. Dourish et al. (2007) suggested that "spaces are not neutral" as they are deeply entrenched in socio-cultural relations. Therefore, geographic relations are reinforced through past and present social links of inhabitants. Within this case, the findings support the argument for greater local autonomy in process and possibly even technology ownership for some of the villages in the study area.

The importance of shared representations in collaborative systems was discussed by Maher et al. (2011) in their analysis of online-based contributor systems. Partly new forms of participation depend on digital infrastructures to be able to name and make visible complex social phenomena in the urban space (de Lange and de Waal 2013). While the information space made up of planning documents and other information artefacts hypothetically presents a shared representation, in reality it is distributed across multiple social settings, sites and incompatible technologies. Therefore, I have argued that the articulation of these geographical relations as presented in CHAPTER 5 may be useful to understand the public groups that form on matters of concern raised in the plan and thus enable those actors to participate with greater ease. As urban planning commonly makes references to objects and phenomena in space, geography plays an important role; indeed its explicit consideration could aid participants in relating to fellow citizens that follow similar topics of interest by articulating their presence and proximity. As an incentive for voluntary participation, a feeling of ownership, the ability and *right* to have influence is essential. Further research is required to confirm this conclusion.

8.2.2 The set-up of the institution(s)

While research in planning increasingly traces actors' relationships and roles in planning outcomes (Tait 2002), there has been less attention given to the ICTs employed and the planners' role in processing, curating and responding to information from public participation initiatives. Research into information systems has often dealt with single technologies, social settings, and timeframes (Monteiro et al. 2012). Consequently, the work in this thesis viewed the multiple, often mundane and incompatible technologies operated by planners over time as an infrastructure[151]. The operational research questions in CHAPTER 6 focused on planners' organisation of participation opportunities and citizens' participation practices over time: How were institutional and technical arrangements developed that enabled or constrained citizens' participation activities? How did participants partake in the development of a local plan and how did they engage in information sharing for this purpose?

Within this case of urban planning, my analysis followed the organisation of the information system(s). It showed multiple circles of participation intensity with planners of the established institution at the centre surrounded by citizen actors with diverse topic or spatial interests. For example, each planner was in charge of authoring a planning document and assessing all incoming citizen feedback. Citizen feedback would cover a wide range of place-related issues involving diverse communities across the physical space of the Lancaster District. In organising participation, planners depend on maintaining momentum to ensure that 'evidence' and facts remain up to date, while participation activities required considerable time and effort.

The analysis used the two levels of collective choices and operational choices to differentiate between the individuals having authority over changes to the technical infrastructure and individuals having the authority to act within the set participation processes. Often, municipal planners determined public infrastructure changes unilaterally based on citizen feedback in official consultations (an operational choice situation). To the existing, 'centrally' organised set-up for participation, the diversity of participants' practices in participation provide considerable organisational challenges. Changes to the technical set-up for online participation events implied shifts in the public-accessible information space. Hence changes to the technical set-up presents an organisational dilemma as it requires citizens to learn new participation practices depending on the change to planners' ICT facilities.

Findings suggested that the interviewed local residents had fewer advanced practices of engaging and re-engaging. Their participation was rather more place-focused and irregular. On the other hand, organisational participants, who were required to monitor participation instances over a long time frame and remotely, had formalised their participation practices often through mundane techniques, such as simple file naming

[151] We may make the controversial claim that this represents 'real urban computing'. Infrastructures are messy and fragile rather than clean and homogenous.

regulations. To participate remotely, some employed specialised ICT facilities to track objects of interests, such as sites in a GIS database. Yet, when I analysed the network of participant-comments-topic relations apparent in the official archival data, the formal instances of participation of the study participants could be related to each other (see APPENDIX III). This suggested the existence of broad participant networks based on shared interests in places or topics.

8.2.3 The embedding of technical interventions

Finally, to understand the practicalities of technical interventions in urban planning that go towards new forms of participation, I studied the experiences of two experts that sought to empower local community groups through spatial technologies. These experts conceptualised new forms of participation through concepts such as "action and& reflection", "in-situ participation", and "multiple participations". Both interventions involved the use of location-enabled smart phones and/or online mapping as augmentation for the participation process and for experts to engage in 'organisation building' by either attempting to revise existing institutional practices and certainly also by supporting community group actors in new forms of participation. This involved efforts to link the formal organisation of municipal government with the informal forms of organisation of citizen groups.

My analysis identified difficulties in providing such technology-facilitated forms of participation through the existing set-up of institutions, as even the two technical experts failed to institutionalise[152] them sustainably[153]. While this was a secondary objective of these projects[154], if indeed an objective at all, it demonstrated the persistence required in intervening technologically. In the example, the lead organisations were ill prepared for hosting a technical intervention that would enable citizens to initiate calls for participation themselves[155].

---

[152] Institutionalisation means the adoption by a local authority, for instance, resulting in the transformation of practices over time.

[153] Sustainability here was associated with the reengagement of users with and through the underlying technology and the resulting adoption by an organisation or a group of organisations that fund the operation of the technology.

[154] Both projects were research-led and did not seek to provide a marketable product.

[155] For example, one expert reported a case of citizen activism in which a community group was able to mobilise resources to collect a total of 85 comments from fellow citizens via the online mapping tool (see the traffic safety case in section 9.2.3). Citizens were able to influence planners with whom they co-wrote a

These new forms of participation (in which any citizen could initiate a call for participation and associated digital data) conflicted with the existing institution's systems and practices that were ill suited to govern such mass participation. On one hand, this reiterates the strong effects of institutional inertia in adopting new practices. On the other hand, it demonstrates that technological interventions have to both consider the requirements of established institutional actors (who often try to operate from top-down) and the various social community groups (from bottom-up). Simple technical utopias, that cannot address the broad range of stakeholders, risk missing both the problems and the specific-realisable opportunities.

8.3 Policy and practical implications of findings

The findings from the two studies were a response to research into new forms of participation in planning. De Lange et al. and de Waal (2013) associated these new forms of participation with the ability to name and visualise complex social phenomena, facilitate a 'sense of place' through personalisation, facilitate self-organisation supported by peer-to-peer reputation systems, and help manage collective actions. As suggested in this conclusion, there is a parallel problem of, firstly, autonomy in participation (to the level of self-governance (Boonstra and Boelens 2011)) and, secondly, the debate over the control of data governance in digital infrastructures (described as the 'right for locality' , see CHAPTER 3(Weise, Hardy, Agarwal, Coulton, Friday and Chiasson 2012a)).

The findings in this thesis speak to 'policy makers', designers of human computer interactionists and community groups. Policy makers, including urban planners, employ various ICTs to support public engagement and thus determine how citizen participation is *experienced*. Human computer interactionists, here, are associated with actors in urban computing and new media who have the capacity to intervene technologically within established practices of participation either in support of policy makers, community groups, or both. Finally, local community groups (including activists and citizens with strong agendas) are of crucial importance in the information ecology of urban planning as local information distributors, processors, and even implementers of government policy[156].

---

final report, but the evidence is inconclusive as to whether this fundamentally influenced the planners in acting on behalf of the community group.

[156] They thus present an essential part of the 'networked publics' involved in relation to matters of concern in urban space. Often they are comprised of non-experts.

In this section I will explain in detail implications for the three actor groups in answering the research question. Based on the two case studies, Table 14 summarises key implications for new forms of participation in regard to the three actor groups discussed previously.

Group	Implications
Planners and institutional actors	• **Systematically capture barriers to participation**. Planners actively organise the information space, therefore they should embed an explicit process of formal learning about the information infrastructure. • **Articulate physical space in participation activity**. Planners should more actively consider the role of physical space in their participation events by, for example, capturing and representing general physical location of participants and the physical locale of objects of their interest. • **Support self-organisation by providing required resources.** Stronger articulation of physical space could lead to the case for further localisation of planning practices as local actors emerge as important mediators (such as in the case parish groups). This also includes giving up authority over the choices taken for particular localities in their remit and instead providing parameters for local actors to implement their own choices.
Human computer interactionists	• **Consider institutional actor's processes.** For sustainable technical interventions, institutional processes need to be considered early on. However, HCI actors need to be careful to provide the needs of local actors by building on open standards for data exchange and underlying technologies. • **Research and implement data sharing models that stretch the prevailing legal frameworks.** The degree of 'local' ownership of the technology is influenced by the provision of institutional frameworks (that support them), for example through neighbourhood planning in the UK, and the economies of scale (a lack of which would reduce them). • **Instil ownership.** By active consideration of established rules of interaction, develop suitable technical means to match established roles and responsibility; compartmentalise by use of interoperability standards
Community group actors	• **Define common grounds.** Clear physical boundaries may be more amenable in rural contexts, while in cities communities would require a strong social cause. • **Establish links and build a strong local network.** Community groups could pool their resources if they wanted more local ownership of the technology they use for planning for instance. On the other hand, established legal frameworks can encourage and discourage such organisation.

Table 14: Important considerations per actor group in enabling new forms of participation in planning

I will now address each group in turn.

8.3.1 Implications for the established institutions

The approach taken in the thesis appreciated that the policy makers' role lies beyond gauging and synthesising citizens' opinions on planning issues but that they, as providers of the formal participation opportunities, combine ICT technologies that facilitate citizen participation. They do so through the provision of information access and the organisation of opportunities to participate. As such, the planners in Lancaster acted from a central perspective, attempting to coordinate development allocations across a wide area, including places linking with many local residents' past and present experiences. As in the question of centralisation or decentralisation of the organisation of information infrastructures, planners do increasingly face the challenge of balancing their traditionally 'top-down' perspective with that of local community groups requiring them, for example, to take decisions for land use jointly.

My research implies that planners should first of all embed an explicit process of continuous learning about the technological infrastructure that they use for participation. By that I mean a systematic and proactive approach to tracking the citizen experience of participating with various technologies that they employ within participation processes across social settings and sites. If planners actively consider citizens' comments in revising their technical infrastructure as shown, planners should take the time to systematically consider technical changes that affect citizen contributors collectively. A continuous improvement process encourages the identification of barriers to participation based on past citizen interactions.

Arriving at such an iterative improvement process indicates the need for funding for adaptive technical development alongside the use of the technology in participation events. Since ICTs are used for public administration's planning efforts, citizens are financing the technological infrastructure indirectly by taxes, and it is therefore reasonable for such tools to be scrutinised by the public. Therefore, it seems reasonable that better suited tools can be expected and, possibly, greater involvement in the set-up of the consultation procedures themselves, in turn requiring a change in mindset of, for example, city council officers.

Another implication is the possible benefit of a stronger articulation of the role of *physical space* in the act of citizen participation and its combination with peer-to-peer reward schemes to enhance voluntary participation. If it is possible to reconstruct spatial patterns in the participation based on the data that municipal planners already have, it means that physical space could be used to draw out matters of shared concern further in supporting engagement across different sites and social settings[157]. The data model as

---

[157] As indicated in CHAPTER 5, the municipal planners hold data in a suitable format to analyse citizen participation in relation to matters of concern (some were location-specific, others were not). However, in this example, planners failed to use this information to represent participation in relation to

delivered in CHAPTER 5 could serve as the baseline for a "planning API[158]" (see APPENDIX V) that can be linked to future technical systems of community groups. The ubiquity of modern geospatial platforms and sophisticated ways of handling geospatial data contribute to this argument. Geo-social technologies are becoming easier to use, maintain, and work with, and their use in planning will become less uncommon. How the municipal government might extend their technical infrastructure to community groups remains however an open question for future work.

Given the institutional changes towards local planning in the UK, such practice could extend to increased local autonomy in planning choices but also ownership of technologies for data processing and storage by local community groups. Planners should actively encourage local groups by formalising processes of data exchange to such 'local' levels. However, although set up in the position paper (CHAPTER 3) it has not become clear whether those people want this burden either (see section 8.4 for a reflective self-critique).

8.3.2 Implications for human-computer interaction

Given that there is a growing need for user-friendly geospatial technologies in planning that are developed primarily for non- experts (Dunn 2007), this raises the question as to why participatory GIS-like applications were rarely successful in the past. I linked the past failures of such geospatial infrastructures to their bespoke application that was usually limited to a small number of social settings and sites. Additionally, as far as the established institution is concerned it may not be useful to confine the use of such technologies to planning alone. Also, scholars of participatory ICT and those who push for ICT implementation within non-technical communities need to recognise that participation without basic technical support is infeasible. At least for enabling local community groups to use digital technologies for their own matters of concern, the Internet enables important economies of scale which is why an online provision of such technological capabilities may be desirable.

---

these matters. Instead, the tabular participation reports provided were grouped according to the names of participants.

[158] Having geo-parsed and coded a large set of consultation-related data, this data scheme had four major data elements, which were citizens, places, comments and media, as well as keywords and themes. The categorisation of participants within planning could be further elaborated but provided a useful step to differentiating between broad level issues and concerns of each group.

This offers a critique of my own argument as to how 'local' the control to a data-collecting information technology could be (see CHAPTER 3). While the diversity of different contexts should be supported in geospatial technologies where possible (for example by custom set-ups on privately-owned servers), operating cost constraints and the need for compatibility across different localities[159] means that there is a need for a degree of uniformity in which a digital platform is hosted online and made available to a large number of users. As it was explained in CHAPTER 7, this was described as an opportunity for the adaptation and adoption of geospatial technologies beyond financially strong expert users (Rattray 2006). In England, there are more than 8805 parishes at the lowest level of political representation of which 6935 (or nearly 75%) represent areas with fewer than 5000 inhabitants. Townsend (2014) speculates that the Pareto rule (80 / 20 rule) extends to the provision of digital technology in which a core infrastructure provision should be standardised with much local diversity in use. Such core infrastructure, if provided by the local authority, could make up for the lack of 'scale' of these 75%.

Yet, while the Internet may serve as a catalyst, there remain many challenges that technical implementers would need to overcome. For example, the study of platform operators (see CHAPTER 7) established that embedding within existing institutional practice is a critical factor for the success of geospatial technology. If the intent is to embed the platform within existing institutional processes, beyond user-trials, ICT developers would need to consider institutional aspects early in the design process. They first need to understand how their design fits with the technical and institutional set-up of established organisations to then determine how their own practices can change existing institutional roles and rules.

Likewise, in terms of technological interventions in a public policy context, there is a danger of the presumption of HCI or technological determinism in the approach to technical interventions. This may result in, that it is not interventions which may not necessarily a incorporate a "people's view" of what technology should be able to do, what data it should be capture, how, and towards which ends (see Hollands (2008)'s critique of agenda of digitalisation driven by corporations interested in obtaining access to urban data). Kubicek (2010) argues that all too often technology interventions haven't considered the institutional and procedural context into which they are to be embedded. ICT interventions require well-conceived compelling stories to be successful and that is the

[159] For example in CHAPTER 4 I indicated that the modes of citizen participation vary across different municipalities based on factors such as the experience of local planners involved and the ICTs available to them.

case for those interventions that seek to stay. As explained by Grudin (1988), for that they require active consideration of the citizens who are at present non-users, actors in the planners' periphery, and groups that are perceived as powerless.

8.3.3 Implications for 'local' individuals and group actors

Within the domain of urban planning, in particular spatial planning, there are many resource allocation problems for land and capital. It was said that in the case of Lancaster, local communities (represented in the form of parishes) tend to want to prevent development allocations while municipal planners have to allocate a set quota of development across these local communities. These local individuals and group actors are a large and diverse group. In the first case study they represented the majority (75%) of participants in the participation process (see CHAPTER 5), and they made most of the user contributions to the process.

It was suggested that planning should incorporate more self-organisation whereby community groups would be given a greater role in organising participation activities (Boonstra and Boelens 2011). In CHAPTER 7, I mentioned that the legal basis for such changes is now available in the UK context in the form of "neighbourhood plans" (Department for communities and local government 2012). What might a new 'institutional' arrangement look like? Given my study outcomes, in which I have shown that in the case of Lancaster, smaller townships had clear geographic representations in the data, it does suggest that a new institutional process for municipal government should support local activism through both its social organisation as well as the ICT facilities that it employs.

Given the dilemmas of diversity in practices of participation that I demonstrated in CHAPTER 6, technological support should enable awareness and communication between different groups, which can be achieved by the indication of proximity facilitated through geospatial platforms. The current set-up seems to offer opportunities for intervention that provide a bridge between the dynamism, local character of these groups and the important role of local government in providing a platform for debate and mediation for local groups. Experience in neighbourhood planning shows that this may be easier in rural contexts in which boundaries between villages are more easily identified. However, the traffic safety case in the second case study suggests that self-organisation is possible if a local group exists that has a strong and distinct social cause.

Therefore local activists and community groups who seek to challenge the practices of engagement of the municipal government, including the technologies and processes involved, should attempt to approach this process through an appreciative enquiry of the capacity of the planners. Similar to how it has been analysed in this thesis, it is important to understand how the existing processes of the municipality work to determine which decisions could be made locally by community groups. However, there are limits as to what can be achieved. These limits are set by national laws and policies.

It may represent a reorganisation of the rules and roles for a new institutional configuration that couples municipal government and emergent self-organising participant groups. It requires the municipal government, as an established institution with political authority, to determine its new role as provider of a communicative forum. The benefit for the local municipality would be that it can break down a larger allocation problem into several smaller chunks by involving local actors and giving them the terms on which they can organise problems within a larger framework of resource allocation. This seems appropriate given that modern digital media enables many new forms of participation that can bridge between different social contexts, sites, and technologies.

8.4 Reflective notes on the position paper — a right for locality?

Finally, I would like to pick up on the argument for localisation of data governance in digital infrastructures provided in the position paper that motivated this work (CHAPTER 3)(Weise, Hardy, Agarwal, Coulton, Friday and Chiasson 2012a). As Graham (2004, p.22) noted, “the ways in which places, and social practices, become enmeshed into geographically and temporally stretched electronic networks such as the Internet is an extraordinarily diverse, contingent process.” Furthermore, Hollands (2008) reiterated that projects seeking to integrate data from business, government and residents raise the question of how to “effectively balance the needs of the community, with both those of local government and the needs of business, particularly corporations” (Hollands 2008, p. 309), as well as the need for differences and mutualism (de Lange and de Waal 2013). The argument for ‘localising’ data governance in a future ubicomp infrastructure is neither an easy nor a clear-cut case depending on a range of factors including national context, the willingness of local authorities, and the size and skill level of local groups.

This ‘right for locality’ in digital infrastructures was approached in this thesis by considering the role of municipal government as a platform provider in planning for the many local individuals and group actors involved. The thesis established a number of points that can count as argument for localisation such as the identification of the spatial activity clusters (see CHAPTER 5), the diversity in practices, agendas with which participants happened to engage (see CHAPTER 6), and also the capacity of community groups to self-organise on important social problems (see CHAPTER 7). After all, a concept of ownership can contribute towards voluntary participation around a matter of shared concern (Boonstra and Boelens 2011). Based on this case, there seems to be a role for an intermediary infrastructure on a municipal level linking both sides in its accessibility but possibly centrally funded, administered, and maintained.

The case here shows that it depends on the national institutional context, too. At least for the UK, through laws such as the localism bill, actors in a great number of localities have begun to prepare neighbourhood plans, thus engaging in local network building and organising (Parker et al. 2014). This supports the case for enhanced local autonomy and therefore for more dedicated technical support. Hence I argue that local diversity could be supported by a common platform that enhances locality by representing the spatially contingent community groups primarily similar in geographic mapping. Further, the differences between community interests could be enhanced by providing a design context in which local individuals and group actors have the capacities to set-up their information space in the way they prefer, including the retention of the data they collect, and maintaining it in a way fit for their purpose.

However there is a danger that the “right for locality” appears to be dependent on the capacity of local communities to come together for their local area depending on their wealth (or financial privation), skills and social capital (or lack thereof). As in most cases, a middle ground of both standardisation of community-group practices, differentiation and diversity depending on local context should be preferred. Technical support of community groups is often needed, which is in conflict with local ownership. CHAPTER 7 reiterated that geospatial technologies remain usually heavily mediated (requiring financial and technical support). Often the operating costs may be beyond what an individual community group can support and therefore local control, while possibly preferred in practice, may be unsustainable from the financial and operational standpoint. Going forward, could this mean that affluent areas may be more likely to choose to stem the financial expense of bespoke and ‘locally-controlled’ technology to become less reliant on freely-provided technologies provided online and what would be their advantage and incentive in doing so?

It may therefore present the case for a third party offering an infrastructure service which introduces standards where there are hardly any at present. Platform operators like those in the second case study become valuable intermediaries between government and community groups. In terms of the value network that emerges between each of them (see Figure 5 in the position paper), this implies a possible useful third party role for technological platforms that aim to support new forms of participation. In the context of planning in the UK, it remains unclear whether these organisations provide components that are designed centrally but operated de-centrally. It is possible that such organisations choose to host a unified geospatial service which emulates local ownership by platform-specific role protocols. In the second case it raises the further question as to whether such a platform might be hosted by the municipal government or by a private provider.

8.5 Next steps and future work

Finally, I will provide a note on the limitations to my work and the future work that can be established based on the limitations and the findings that I detailed in individual thesis chapters. For example, in the course of this research, the topic of neighbourhood planning emerged as interesting topic for information systems researchers. It presents a change to the UK planning system that was introduced in 2011. At the time of writing, there are hardly any studies of information technology use within neighbourhood planning groups.

8.5.1 Limitations in the present work

There are a number of important limitations to this thesis. There was a shift in the national context of each case studies. It was the purpose of the thesis to show participation practices under different socio-technological contexts but not to compare the urban planning models that exist between countries. In the UK, planning literature has noted a prevalent neoliberalism, characterising planning as quasi legal (which means that planning choices are often deliberated in forums that are similar to that of a court of law) and applying discretion over individual planning projects compared to other European countries (Cullingworth and Nadin 2006).

Other limitations to this work reside in the chosen sample frames. In the main case study, a purposeful sample was carefully crafted to mitigate overemphasis on any particular contributor type. However, time limitations have made it difficult to include local residents who may have contributed informally (thus were excluded within the archival data). This was mitigated by reaching out to citizens in libraries but few could be included in the actual study due to selection criteria. Likewise in the comparative study of new forms of participation, the purpose was to focus on the experience of the technological experts, but then excluded interviewees of members of the communities involved in new interactions using the ICT facilities presented by the technological facilitators.

The use of the conceptual framework embedded a strong understanding of system-level patterns of interaction but possibly less so an understanding of the 'micro' human computer interactions that activity theory would be better in uncovering through detailed participant observation. Participants in the main case study were asked about their interactions with ICTs to engage in planning. This could be considered in further detail in future work.

8.5.2 Future work

Beyond the research findings presented in this thesis, additional future work remains to be done. A potential problem is the observed diversity in participation levels, in which more affluent areas showed greater local cohesion, and hence activism, and further work would need to establish what this may mean for deprived areas' ability to organise and solve urban planning problems.

For example, further work could extend the geospatial analysis of place-citizen relations that I developed (see CHAPTER 5). For example, data on the participation activities in spatial planning from several local authorities should be combined to draw comparisons in the different patterns of interaction. It can be assumed, for example, that the spatial patterns of participation will vary widely between localities depending on many factors including population density, levels of education and composition of the local property market. How widely do the patterns of participation (also geographically) vary between localities depending on local factors such as population density, education and property? Who had the most impact on the content of planning documents? What would such evidence tell about the power structures in urban planning in the UK?

Unlike the present study, future work could take an action research approach by trying to intervene. While the nature of my work can be described as research-for-design, this alternative research-through-design approach would involve the development of technological prototypes that could be tested within the planning system. Examples of such technological prototypes were given in CHAPTER 7 which talked about the experiences of two technological facilitators.

The use of the conceptual framework embedded a strong understanding of system-level patterns of interaction but possibly less so an understanding of the 'micro' human computer interactions that activity theory would be better in uncovering. Participants in the main case study were asked about their interactions with ICTs to engage in planning but this could be considered in further detail. Methodologically, future work could expand the analysis strategy that I presented in CHAPTER 4. It prompts a discussion of the role of participation in design using an institutional analysis approach that drew on the IAD framework. It is a consultative tool well suited to the analysis of information infrastructures. Further work could explore how this framework can be applied in a forward-looking manner in an action research approach. Further work could explore how this methodology could be combined with Actor Network Theory or Activity Theory. For example, Activity Theory describes the concept of rule-forming activity systems. How does this compare to the approach of rules in the IAD? How can an activity theoretical focus on 'objects' be incorporated even more explicitly into an evolved version of the IAD framework.

In terms of the local community groups' use of geospatial technologies, future studies could compare two or more successful use cases. Future studies may want to focus on the links between different levels of political authority and community groups, studying their practices of data sharing for a common social goal (such as the development of a plan). This might shift the dilemmas in data access into focus beyond the issues of ICT facilities used by community groups, established institution(s), and possible business organisation(s).

8.6 Concluding remarks

Since the publication of the position paper for this work (CHAPTER 3)(Weise, Hardy, Agarwal, Coulton, Friday and Chiasson 2012a), there has been a growing awareness of the importance of geographical space as evidenced through recent work by Graham et al.and Zook (2013) and contemporary geopolitical developments of spying scandals and trade embargoes resulting in a growing awareness of the geospatial component of global Internet policies. This wider context appears to support a change in the debate on proper governance of physical computing devices and participatory sensing. In this debate, as shown here through an in-depth study of urban planning, a stronger consideration of geography is warranted in support of the governance of ICT facilities and in the establishment of new forms of participation that enable a closer link between the physical space that citizens use and their political engagement in relation to this space. This thesis contributed insight to an exciting, novel, emerging field of research that will in the long-run change the way that established institutions organise and understand participation. In this context, while ICT facilities may enable ever increasing numbers of individuals to participate, this case has highlighted that the physical context in effect provides limits to what can be done and debated digitally. Thus, this thesis has enforced the role of physical space as an important, interesting common denominator that results in complex participation dynamics as different citizens engage in dialogues with their different readings of the role and purpose of particular places.

References

Abowd, G.D. and Mynatt, E.D. (2000). Charting past, present, and future research in ubiquitous computing. ***ACM TOCHI***, 7(1), pp.29–58.

Ackerman, M.S. (2000). The Intellectual Challenge of CSCW: The Gap Between Social Requirements and Technical Feasibility. ***Human-Computer Interaction***, 15(2), pp.179–203.

Albrecht, S. (2006). Whose voice is heard in online deliberation?: A study of participation and representation in political debates on the internet. ***Information, communication and Society***, 9(1), pp.62–82.

Alexander, C. (1966). A city is not a tree. p.18.

Alt, F. et al. (2010). Location-based crowdsourcing: extending crowdsourcing to the real world. In Proceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries. ACM, pp. 13–22.

Amin, A. (2014). Lively Infrastructure. ***Theory, Culture & Society***, *31*(7-8), 137–161.

Annechino, R., Antin, T.M. and Lee, J.P. (2010). Bridging the qualitative-quantitative software divide. ***Field Methods***, 22(2), pp.115–124.

Anon. Lancaster urban planning.

Anon. LIVE Singapore! *SENSEABLE CITY LAB*. [online]. Available from: http://senseable.mit.edu/livesingapore/ [Accessed December 12, 2014].

Anon. Tech City Map. ***trampolinesystems.com***. [online]. Available from: http://www.techcitymap.com/index.html#/about [Accessed 2012].

Arnstein, S.R. (1969). A ladder of citizen participation. ***Journal of the American Planning Association***, 35(4), pp.216–224.

Arthur, W.B. (2009). ***The Nature of Technology***. Simon and Schuster.

Avison, D. and Elliot, S. (2006). Scoping the discipline of information systems. ***Information Systems: The State of the Field***, pp.3–18.

Baker, M., Hincks, S. and Sherriff, G. (2010). Getting involved in plan making: participation and stakeholder involvement in local and regional spatial strategies in England. ***Environment and planning. C, Government & policy***, 28(4), pp.574–594.

Banai, R. (2012). Plan vs Project Dilemma Revisited: A Progress Review of Urban and Regional Studies Literature. ***Urban Studies***, 50(4), pp.807–824.

Bannon, L. (2000). Understanding common information spaces in CSCW. In Workshop on Cooperative Organisation of Common Information Spaces, Technical University of Denmark.

Bannon, L. and Bødker, S. (1997). Constructing common information spaces. In Fifth European conference on computer supported cooperative work. Kluwer Academic Publishers, Netherlands, pp. 81–96.

Baskerville, R.L. and Myers, M.D. (2014). Design ethnography in information systems. ***Information Systems Journal***, 25(1), pp.23–46.

Bawa-Cavia, A. (2011). Sensing the urban: using location-based social network data in urban analysis. In Pervasive PURBA Workshop.

Benkler, Y. (2007). ***The Wealth of Networks***. Yale Univ Pr.

Bertelsen, O.W. and Bødker, S. (2003). Activity theory. In J. M. Carroll, ed. ***HCI Models, Theories, and Frameworks: Toward a Multidisciplinary Science***. Elsevier, pp. 291–324.

Bettencourt, L.M.A. et al. (2007). Growth, innovation, scaling, and the pace of life in cities. ***Proceedings of the National Academy of Sciences***, 104(17), pp.7301–7306.

Bilandzic, M. and Venable, J. (2011). Towards participatory action design research: adapting action research and design science research methods for urban informatics. ***The Journal of Community Informatics***, 7(3).

Birmingham City Council ed. (2012). ***Birmingham Civic Dashboard***. [online]. Available from: http://civicdashboard.org.uk/ [Accessed 2012].

Bohøj, M. et al. (2011). Public deliberation in municipal planning: supporting action and reflection with mobile technology. ***Proceedings of the 5th International Conference on Communities and Technologies***, pp.88–97.

Boonstra, B. and Boelens, L. (2011). Self-organization in urban development: towards a new perspective on spatial planning. ***Urban Research & Practice***, 4(2), pp.99–122.

Bossen, C. (2002). The parameters of common information spaces:: the heterogeneity of cooperative work at a hospital ward. In Proceedings of the 2002 ACM conference on Computer supported cooperative work. ACM, pp. 176–185.

Brabham, D.C. (2008). Crowdsourcing as a Model for Problem Solving: An Introduction and Cases. ***Convergence: The International Journal of Research into New Media Technologies***, 14(1), pp.75–90.

Brabham, D.C. (2009). Crowdsourcing the public participation process for planning projects. ***Planning Theory***, 8(3), pp.242–262.

Brabham, D.C., Sanchez, T. and Bartholomew, K. (2010). Crowdsourcing public participation in transit planning: Preliminary results from the Next Stop design case. ***Transportation Research Board of the National Academies***.

Brownill, S. and Carpenter, J. (2007). Increasing participation in planning: Emergent experiences of the reformed planning system in England. ***Planning, Practice & Research***, 22(4), pp.619–634.

Bruns, A. (2008). Life beyond the public sphere: Towards a networked model for political deliberation. *Information Polity*, 13(1), pp.71–85.

Brush, A. (2010). Exploring end user preferences for location obfuscation, location-based services, and the value of location. In Proceedings of the 12th ACM international conference on Ubiquitous computing. ACM, pp. 95–104.

Bryant, S.L., Forte, A. and Bruckman, A. (2005). Becoming Wikipedian: transformation of participation in a collaborative online encyclopedia. *Proceedings of the 2005 international ACM SIGGROUP conference on Supporting group work*, pp.1–10.

Buckland, M.K. (1991). Information as thing. *Journal of the American Society for Information Science and Technology*, 42(5), pp.351–360.

Bugs, G. (2012). Assessment of online PPGIS study cases in urban planning. *Computational Science and Its Applications–ICCSA 2012*, pp.477–490.

Bugs, G. et al. (2010). An assessment of Public Participation GIS and Web 2.0 technologies in urban planning practice in Canela, Brazil. *Cities*, 27(3), pp.172–181.

Burke, J.A. et al. (2006). Participatory sensing. In WSW'06 at SenSys'06.

Bødker, S. (1990). Activity theory as a challenge to systems design. *ojs.statsbiblioteket.dk*.

Bødker, S. and Zander, P.O. (2015). Participation in design between public sector and local communities. *… the 7th International Conference on Communities …*, pp.49–58.

Calabrese, F. et al. (2010). Real-time urban monitoring using cell phones: A case study in Rome. *Intelligent Transportation Systems, IEEE Transactions on*, (99), pp.1–11.

Carmona, M. et al. (2010). *Public Places, Urban Spaces: The Dimensions of Urban Design*. Routledge.

Carrera, F. and Ferreira, J. (2007). The Future of Spatial Data Infrastructures: Capacity building for the Emergence of Municipal SDIs. *International Journal of Spatial Data Infrastructures Research*, 2, pp.49–68.

Carroll, J.M. (2005). The Blacksburg Electronic Village: A study in community computing. *Digital Cities III. Information Technologies for Social Capital: Cross-cultural Perspectives*, pp.43–65.

Castells, M. (2010). Globalisation, Networking, Urbanisation: Reflections on the Spatial Dynamics of the Information Age. *Urban Studies*, 47(13), pp.2737–2745.

Castells, M. (2002). Local and Global: Cities in the Network Society. *Tijdschrift voor Economische en Sociale Geografie*, 93(5), pp.548–558.

Castells, M. (2000). *The Rise of the Network Society (The Information Age: Economy, Society and Culture, Volume 1) (Vol 1)*. 2nd ed. Wiley-Blackwell.

Cáceres, R. and Friday, A. (2012). Ubicomp Systems at 20: Progress, Opportunities, and Challenges. *IEEE Pervasive Computing*, 11(1), pp.14–21.

Chen, Y. et al. (2010). Social comparisons and contributions to online communities: A field experiment on movielens. *The American Economic Review*, 100(4), pp.1358–1398.

Chilana, P.K., Ko, A.J. and Wobbrock, J.O. (2015). From User-Centered to Adoption-Centered Design: A Case Study of an HCI Research Innovation Becoming a Product. *CHI*, pp.1–10.

CKAN. About CKAN. *CKAN*. [online]. Available from: http://ckan.org/about/ [Accessed 2012].

Conti, M. et al. (2012). Looking ahead in pervasive computing: Challenges and opportunities in the era of cyber–physical convergence. *Pervasive and Mobile Computing*, 8(1), pp.2–21.

Cosm. About Cosm. *cosm.com*. [online]. Available from: https://cosm.com/about_us [Accessed 2012].

Crampton, J.W. and Elden, S. (2007). *Space, Knowledge and Power*. amazon.com.

Crang, M., Crosbie, T. and Graham, S. (2007). Technology, time – space, and the remediation of neighbourhood life. *Environment and Planning A*, 39(10), pp.2405–2422.

Crowston, K. (2011). Lessons from volunteering and free/libre open source software development for the future of work. *Researching the Future in Information Systems*, pp.215–229.

Crowston, K. et al. (2012). Free/libre open source software: What we know and what we do not know. *ACM Computing Surveys*, 44(2).

Cuff, D., Hansen, M. and Kang, J. (2008). Urban sensing: out of the woods. *Communications of the ACM*, 51(3), pp.24–33.

Cullingworth, B. and Nadin, V. (2006). *Town and Country Planning in the UK*. New York: Routledge.

Dalsgaard, P. (2014). Pragmatism and design thinking. *International Journal of Design*.

Davey, K. (1993). *Elements of urban management*. World Bank.

de Lange, M. and de Waal, M. (2013). Owning the city: New media and citizen engagement in urban design. *First Monday*.

Deakin, H. and Wakefield, K. (2013). Skype interviewing: Reflections of two PhD researchers. *Qualitative Research*, 14(5).

Department for communities and local government. (2012). Giving communities more power in planning local development. *gov.uk*, pp.1–3. [online]. Available from:

https://www.gov.uk/government/policies/giving-communities-more-power-in-planning-local-development/supporting-pages/neighbourhood-planning [Accessed October 4, 2014].

Doak, J. and Parker, G. (2005). Networked space? The challenge of meaningful participation and the new spatial planning in England. ***Planning, Practice & Research***, 20(1), pp.23–40.

Doan, A., Ramakrishnan, R. and Halevy, A.Y. (2011). Crowdsourcing systems on the world-wide web. ***Communications of the ACM***, 54(4), pp.86–96.

Dodge, M. and Kitchin, R. (2005). Code and the Transduction of Space. ***Annals of the Association of American Geographers***, 95(1), pp.162–180.

Dourish, P. (2006). Re-space-ing place: "place" and 'space' ten years on. In Proceedings of the 2006 20th anniversary conference on Computer supported cooperative work. pp. 299–308.

Dourish, P. and Bell, G. (2007). The infrastructure of experience and the experience of infrastructure: meaning and structure in everyday encounters with space. ***Environment and Planning B: Planning and Design***, 34(3), p.414.

Downs, A. (1967). A realistic look at the final payoffs from urban data systems. ***Public Administration Review***, 27(3), pp.204–210.

Dunn, C.E. (2007). Participatory GIS a people's GIS? ***Progress in Human Geography***, 31(5), pp.616–637.

Dunn, N. (2013). The End of Architecture?: NetworkedCommunities, Urban Transformation andPost-capitalist Landscapes. ***Spaces and Flows: An International Journal on Urban and ExtraUrban Studies***, 3, pp.1–9.

Dunton, J. (2014). Just one in seven authorities have local plan that complies with NPPF. ***planningresource.co.uk***. [online]. Available from: http://www.planningresource.co.uk/article/1299337/just-one-seven-authorities-local-plan-complies-nppf [Accessed April 2015].

Durrance, J.C. et al. (2006). The role of community-based, problem-centered information intermediaries in local problem solving. In Proceedings of the American Society for Information Science and Technology. Wiley Online Library.

Engeström, Y. and Escalante, V. (1996). Mundane tool or object of affection? The rise and fall of the postal buddy. In B. A. Nardi, ed. ***Context and Consciousness: Activity Theory and Human-Computer Interaction***. MIT Press, pp. 325–374.

Falleth, E.I. and Hansen, G.S. (2011). Participation in planning. ***European Journal of Spatial Development***.

Fischer, F. (2000). ***Citizens, Experts, and the Environment: The Politics of Local Knowledge***.

Duke University Press.

Fischer, G. et al. (2004). Meta-design: a manifesto for end-user development. ***Communications of the ACM***, 47(9), pp.33–37.

Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. ***Qualitative Inquiry***, 12(2), pp.219–245.

Flyvbjerg, B. (2005). Design by deception: The politics of megaproject approval. ***Harvard Design Magazine***, 22, pp.50–59.

Forester, J. (1989). ***Planning in the Face of Power***. Univ of California Press.

Foth, M., Choi, J.H.-J. and Satchell, C. (2011). Urban Informatics. In Proceedings of the ACM 2011 conference on Computer supported cooperative work. pp. 1–8.

Friese, S. (2012). ***Qualitative Data Analysis with ATLAS.ti***. Sage.

Froehlich, J., Neumann, J. and Oliver, N. (2008). Measuring the pulse of the city through shared bicycle programs. ***Proc. of UrbanSense08***, pp.16–20.

Galloway, A. (2004). Intimations of everyday life: Ubiquitous computing and the city. ***Cultural Studies***, 18(2-3), pp.384–408.

Gartner. (2015). Gartner says smart cities will use 1.1 billion connected things in 2015. ***gartner.com***. [online]. Available from: http://www.gartner.com/newsroom/id/3008917 [Accessed March 2015].

Garud, R., Jain, S. and Tuertscher, P. (2008). Incomplete by design and designing for incompleteness. ***Organization Studies***, 29(3), pp.351–371.

Geertman, S. and Stillwell, J. eds. (2009). ***Planning Support Systems Best Practice and New Methods***. Springer.

Gleave, E. et al. (2009). A conceptual and operational definition of‘social role’in online community. In System Sciences, 2009. HICSS'09. 42nd Hawaii International Conference on. IEEE, pp. 1–11.

Goldkuhl, G. (2012). Pragmatism vs interpretivism in qualitative information systems research. ***European Journal of Information Systems***, pp.135–146.

Gonzalez, M., Hidalgo, C.A. and Barabási, A.L. (2008). Understanding individual human mobility patterns. ***Nature***, 453(7196), pp.779–782.

Goodchild, M. (2007). Citizens as sensors: the world of volunteered geography. ***GeoJournal***, 69(4), pp.211–221.

Goodchild, M. (2009). NeoGeography and the nature of geographic expertise. ***Journal of Location Based Services***, 3(2), pp.82–96.

Goodchild, M. et al. (2000). Toward spatially integrated social science. *International Regional Science Review*, 23(2), pp.139–159.

Graham, M. and Zook, M.A. (2013). Augmented realities and uneven geographies: exploring the geolinguistic contours of the web. *Environment and Planning A*, 45(1), pp.77–99.

Graham, M., Zook, M.A. and Boulton, A. (2013). Augmented reality in urban places: contested content and the duplicity of code. *Transactions of the Institute of British Geographers*, 38(3), pp.464–479.

Graham, S. (2004). Beyond the 'dazzling light': from dreams of transcendence to the 'remediation'of urban life. *New Media and Society*, pp.16–25.

Graham, S. and Healey, P. (1999). Relational concepts of space and place: issues for planning theory and practice. *European Planning Studies*, 7(5), pp.623–646.

Graham, S. and Marvin, S. (2001). *Splintering urbanism*. Psychology Press.

Grudin, J. (1988). Why CSCW applications fail: problems in the design and evaluationof organizational interfaces. In Proceedings of the 1988 ACM conference on Computer-supported cooperative work. ACM, pp. 85–93.

Gurstein, M. (2007). What is Community Informatics (and Why Does It Matter)? In G. Sica, ed. *Publishing studies*. Polimetrica s.a.s., p. 109.

Hahmann, S. and Burghardt, D. (2013). How much information is geospatially referenced? Networks and cognition. *International Journal of Geographical Information Science*, 27(6), pp.1171–1189.

Haklay, M. (2008). Openstreetmap: User-generated street maps. *IEEE Pervasive Computing*, 7(4), pp.12–18.

Han, S.Y. and Kim, T.J. (1989). Can expert systems help with planning? *Journal of the American Planning Association*, 55(3), pp.296–308.

Hanna, P. (2012). Using internet technologies (such as Skype) as a research medium: a research note. *Qualitative Research*, 12(2), pp.239–242.

Hanseth, O., Monteiro, E. and Hatling, M. (1996). Developing information infrastructure: the tension between standardisation and flexibility. *Science, technology & human values*, 21(4), pp.407–426.

Harrison, S. and Dourish, P. (1996). Re-place-ing space: the roles of place and space in collaborative systems. In Proceedings of the 1996 ACM conference on Computer supported cooperative work. ACM, pp. 67–76.

Healey, P. (1999). Institutionalist analysis, communicative planning, and shaping places. *Journal of planning education and research*, 19(2), pp.111–121.

Healey, P. (2006). ***Urban Complexity and Spatial Strategies***. Routledge.

Hecht, B. and Gergle, D. (2011). A Beginner's Guide to Geographic Virtual Communities Research. ***Handbook of Research on Methods and Techniques for Studying Virtual Communities: Paradigms and Phenomena***, pp.333–347.

Hess, C. (1995). The virtual CPR: the Internet as a local and global common pool resource. In Reinventing the Commons, the Fifth Biennial Conference of the International Association for the Study of Common Property. Bodoe, Norway: Citeseer.

Hess, C. and Ostrom, E. (2006). A Framework for Analyzing the Knowledge Commons: a chapter. In ***Understanding Knowledge as a Commons: from Theory to Practice***. The MIT Press, p. 384.

Hess, C. and Ostrom, E. (2003). Ideas, artifacts, and facilities: Information as a common-pool resource. ***Law and Contemporary Problems***, 66(1/2), pp.111–145. [online]. Available from: http://scholarship.law.duke.edu/cgi/viewcontent.cgi?article=1276&context=lcp.

Hess, C. and Ostrom, E. (2011). ***Understanding Knowledge as a Commons***. MIT Press (MA).

Hollands, R. (2008). Will the real smart city please stand up? ***City***, 12(3), pp.303–320.

Howe, J. (2006). The Rise of Crowdsourcing. ***WIRED***. [online]. Available from: http://www.wired.com/wired/archive/14.06/crowds.html?pg=4&topic=crowds&topic_set = [Accessed January 18, 2012].

Innes, J.E. (1998). Information in communicative planning. ***Journal of the American Planning Association***, 64(1), pp.52–63.

Innes, J.E. and Booher, D.E. (2010). ***Planning with Complexity***. Taylor & Francis.

Innes, J.E. and Booher, D.E. (2004). Reframing public participation: strategies for the 21st century. ***Planning Theory & Practice***, 5(4), pp.419–436.

Innes, J.E. and Simpson, D.M. (1993). Implementing GIS for Planning Lessons from the History of Technological Innovation. ***Journal of the American Planning Association***, 59(2), pp.230–236.

Irvine, A., Drew, P. and Sainsbury, R. (2012). 'Am I not answering your questions properly?': Clarification, adequacy and responsiveness in semi-structured telephone and face-to-face interviews. ***qual res***, 13(1), pp.87–106.

Jackson, S.J., Gillespie, T. and Payette, S. (2014). The policy knot. In Proceedings of the 2014 17th ACM conference on computer supported collaborative work. New York, New York, USA: ACM Press, pp. 588–602.

Kanjo, E. (2010). NoiseSPY: A Real-Time Mobile Phone Platform for Urban Noise Monitoring and Mapping. ***Mobile Networks & Applications***, 15(4), pp.562–574.

Kanter, J. (2012). E.U. Presses Google to Delay Privacy Policy Changes. ***The New York***

Times. [online]. Available from: http://tinyurl.com/chmdtju [Accessed December 2014].

Kelley, M.J. (2014). The semantic production of space: pervasive computing and the urban landscape. ***Environment and Planning A***, 46(4), pp.837–851.

Kesselring, V.K.A.S. and Canzler, W. (2008). ***Tracing Mobilities (Transport and Society)***. W. Canzler, V. Kaufmann, & S. Kesselring, eds. Ashgate.

Kingston, R. (2002). The role of e-government and public participation in the planning process. ***XVI Aesop Congress Volos, available at: http://www. ccg. leeds. ac. uk/democracy/presentations/AESOP_kingston. pdf***.

Kingston, R. et al. (2000). Web-based public participation geographical information systems: an aid to local environmental decision-making. ***Computers, Environment and Urban Systems***, 24(2), pp.109–125.

Korn, M. and Back, J. (2012). Talking it Further: From Feelings and Memories to Civic Discussions In and About Places. In Proceedings of the 7th Nordic Conference on Human-Computer Interaction: Making Sense Through Design. pp. 189–198.

Kubicek, H. (2010). The Potential of E-Participation in Urban Planning: A European Perspective. In C. N. Silva, ed. ***Handbook of Research on E-Planning: ICTs for Urban Development and Monitoring***. IGI Global, pp. 168–194.

Kumar, M. and Conti, G. (2012). NSF/EU Workshop on Future Directions in Pervasive Computing and Social Networking for Emerging Applications. pp.1–5.

Langley, A. (2009). Studying processes in and around organizations. ***The Sage handbook of organizational research methods***, pp.409–429.

Langley, A. and Tsoukas, H. (2010). Introducing 'Perspectives on Process Organization Studies'. In T. Hernes & S. Maitlis, eds. ***Process, sensemaking & organizing***. Oxford University Press, USA, pp. 1–26.

Latour, B. (1962). ***Visualisation and Cognition: Drawing Things Together***.

Leahu, L., Sengers, P. and Mateas, M. (2008). Interactionist AI and the promise of ubicomp, or, how to put your box in the world without putting the world in your box. ***Proceedings of the 10th international conference on Ubiquitous computing***, pp.134–143.

Leitner, H. et al. (2002). Models for making GIS available to community organizations: dimensions of difference and appropriateness. ***Community participation and geographic information systems***, pp.37–52.

Lindsay, G. (2010). A City in the Cloud: Living PlanIT Redefines Cities as Software. ***Fast Company***, pp.1–5.

Local Government Association. (2015). ***Transforming local public services***. London: Local Government Association. [online]. Available from: http://www.local.gov.uk/documents/10180/11553/Transforming+public+services+using+t echnology+and+digital+approaches/ab9af2bd-9b68-4473-ac17-bbddf2adec05.

Lowndes, V., & Roberts, M. (2013). Why Institutions Matter. Palgrave Macmillan.

Luke, D.A. (2005). Getting the big picture in community science: Methods that capture context. ***American Journal of Community Psychology***, pp.185–200.

Maher, M.L., Paulini, M. and Murty, P. (2011). Scaling up: From individual design to collaborative design to collective design. ***Design Computing and Cognition'10***, pp.581–599.

Maisonneuve, N., Stevens, M. and Ochab, B. (2010). Participatory noise pollution monitoring using mobile phones. ***Information Polity***, 15(1), pp.51–71.

Massey, D. (1993). Power-geometry and a progressive sense of place. In J. Bird et al., eds. ***Mapping the futures: Local cultures, global change***. Routledge London, pp. 59–69.

Mayo, E. and Steinberg, T. (2007). The Power of Information. pp.1–57. [online]. Available from: http://www.opsi.gov.uk/advice/poi/power-of-information-review.pdf.

McCall, M.K. and Dunn, C.E. (2012). Geo-information tools for participatory spatial planning: Fulfilling the criteria for 'good' governance? ***Geoforum***, 43(1), pp.81–94.

McCullough, M. (2013). ***Ambient Commons***. MIT Press.

McCullough, M. (2005). ***Digital Ground: Architecture, Pervasive Computing, and Environmental Knowing***. New edition. The MIT Press.

Meier, P. (2012). How Crisis Mapping Saved Lives in Haiti. ***voices.nationalgeographic.com***. [online]. Available from: http://voices.nationalgeographic.com/2012/07/02/crisis-mapping-haiti/ [Accessed March 2015].

Mejova, Y. et al. (2011). Reuse in the wild: an empirical and ethnographic study of organizational content reuse. ***Proceedings of the 2011 annual conference on Human factors in computing systems***, pp.2877–2886.

Miles, M.B., Huberman, A.M. and Saldaña, J. (2014). ***Qualitative data analysis : a methods sourcebook***. SAGE Publications.

Miller, H.J. (2004). Tobler's first law and spatial analysis. ***Annals of the Association of American Geographers***, 94(2), pp.284–289.

Mitchell, W.J. (2000). ***E-Topia***. The MIT Press.

Mitev, N. and Howcroft, D. (2011). Post-structuralism, Social Shaping of Technology, and Actor-Network Theory: What Can They Bring to IS Research? In ***The Oxford Handbook of Management Information Systems: Critical Perspectives and New Directions***. Oxford University Press, p. 292.

Mjøset, L. (2009). The contextualist approach to social science methodology. ***The Sage handbook of case-based methods, London: Sage***, pp.39–69.

Molin-Juustila, T., Nuojua, J. and Kuutti, K. (2008). Urban planning and ubicomp design: Do we need to extend legally enforced participation? In Proceedings of the 5th Nordic conference on Human-computer interaction: building bridges. ACM, pp. 515–518.

Monteiro, E. and Hanseth, O. (1996). Social shaping of information infrastructure: on being specific about the technology. In W. Orlikowski et al., eds. ***Information technology and changes in organizational work***. Chapman and Hall, London, pp. 325–343.

Monteiro, E. et al. (2012). From Artefacts to Infrastructures. ***Computer Supported Cooperative Work (CSCW)***, 22(4-6), pp.575–607.

Muller, M. et al. (2011). Circles of Crowdsourcing: The Social Organization of Participatory Sensing. In MobileHCI 2011.

Mumford, E. (2006). The story of socio-technical design: reflections on its successes, failures and potential. ***Information Systems Journal***, 16(4), pp.317–342.

Murdoch, J. (2006). ***Post-structuralist Geography***. SAGE.

Murmann, J.P. (2010). Constructing Relational Databases to Study Life Histories on Your PC or Mac. ***Historical Methods***, 43(3), pp.109–123.

Mydex. ***Our service***. ***MYDEX***. [online]. Available from: http://mydex.org/our-service/ [Accessed 2012].

Nardi, B.A. (1996). Studying context: A comparison of activity theory, situated action models, and distributed cognition. In B. A. Nardi, ed. ***Context and consciousness: Activity theory and human-computer interaction***. MIT Press, pp. 69–102.

NESTA. (2013). ***UK Demand for Hyperlocal Media***.

Nonnecke, B. and Preece, J. (2000). Lurker demographics: Counting the silent. ***Proceedings of the SIGCHI conference on Human factors in computing systems***, pp.73–80.

Nuojua, J. (2010). WebMapMedia: a map-based Web application for facilitating participation in spatial planning. ***Multimedia systems***, 16(1), pp.3–21.

Nye, D.E. (1992). ***Electrifying America: Social Meanings of a New Technology, 1880-1940***. The MIT Press.

O'Connor, H. et al. (2008). Internet-based Interviewing. In N. G. Fielding, R. M. Lee, & G. Blank, eds. ***The SAGE Handbook of Online Research Methods***. 1 Oliver's Yard, 55 City Road, London England EC1Y 1SP United Kingdom : SAGE Publications, Ltd.

Office for National Statistics. (2011). ***2011 Census***.

Ojala, T. et al. (2010). UBI-hotspot 1.0: Large-scale long-term deployment of interactive public displays in a city center. ***Internet and Web Applications and Services (ICIW), 2010 Fifth International Conference on***, pp.285–294.

Oliver, D.G., Serovich, J.M. and Mason, T.L. (2005). Constraints and opportunities with interview transcription: Towards reflection in qualitative research. ***Social Forces***, 84(2), pp.1273–1289.

Orlikowski, W. (2010). The sociomateriality of organisational life: considering technology in management research. ***Cambridge Journal of Economics***, *34*(1), 125–141.

Ostrom, E. (1986). An agenda for the study of institutions. ***Public Choice***, 48(1), pp.3–25.

Ostrom, E. (2005). ***Understanding Institutional Diversity***. Princeton University Press.

Oudejans, M. and Christian, L.M. (2010). Using interactive features to motivate and probe responses to open-ended questions. In M. Das, P. Ester, & L. Kaczmirek, eds. ***Social and Behavioral Research and the Internet: Advances in Applied Methods and Research Strategies***. Routledge.

Panciera, K. et al. (2010). Lurking? cyclopaths?: a quantitative lifecycle analysis of user behavior in a geowiki. ***Proceedings of the 28th international conference on Human factors in computing systems***, pp.1917–1926.

Parker, G., Lynn, T. and Wargent, M. (2014). ***User Experience of Neighbourhood Planning in England***. University of Reading.

Paulos, E., Honicky, R.J. and Hooker, B. (2008). Citizen science. In ***Enabling participatory urbanism***. Handbook of Research on Urban Informatics, pp. 414–436.

Pettigrew, A.M. (1990). Longitudinal field research on change: theory and practice. ***Organization Science***, 1(3), pp.267–292.

Poslad, S. (2009). ***Ubiquitous Computing: Smart Devices, Environments and Interactions***. Wiley.

Quercia, D., Séaghdha, D. and Crowcroft, J. (2012). Talk of the City: Our Tweets, Our Community Happiness. In ***Proceedings of the Sixth International AAAI Conference on Weblogs and Social Media***.

Quinn, A.C. and Ramasubramanian, L. (2007). Information technologies and civic engagement: Perspectives from librarianship and planning. ***Government Information Quarterly***, 24(3), pp.595–610.

Quinn, A.J. and Bederson, B.B. (2010). Human Computation: Charting The Growth Of A Burgeoning Field. ***Computer***, 1(3), pp.10–37.

Rambaldi, G. et al. (2006). Mapping for change: practice, technologies and communication. ***Participatory Learning and Action***, (54).

Rashid, A.M. et al. (2006). Motivating participation by displaying the value of contribution. In Proceedings of the SIGCHI conference on Human factors in computing systems. ACM, pp. 955–958.

Ratti, C., Sevtsuk, A., Huang, S., & Pailer, R. (2007). Mobile landscapes: Graz in real time. *Location Based Services and Telecartography*, 433–444.

Ratti, C., Williams, S., Frenchman, D., & Pulselli, R. M. (2006). Mobile landscapes: using location data from cell phones for urban analysis. *Environment and Planning B: Planning and Design*, *33*(5), 727.

Rattray, N. (2006). A user-centered model for community-based Web-GIS. ***Journal of Urban and Regional Information Systems Association***, 18(2), pp.25–34.

Rideout, V., Reddick, A., O'Donnell, S., McIver, W., Jr, Kitchen, S., & Milliken, M. (2007). Community Organizations in the Information Age: A study of community intermediaries in Canada. ***The Journal of Community Informatics***, *3*(1).

Rinner, C. (1999). Argumaps for spatial planning. In First International Workshop on Telegeoprocessing.

Rinner, C. and Bird, M. (2009). Evaluating community engagement through argumentation maps-a public participation GIS case study. ***Environment and Planning B: Planning and Design***, 36, pp.588–601.

Rittel, H. and Webber, M.M. (1973). Dilemmas in a General Theory of Planning. ***Policy sciences***, 4, pp.155–169.

Rogers, Y. (2006). Moving on from weiser's vision of calm computing: Engaging ubicomp experiences. ***UbiComp 2006: Ubiquitous Computing***, pp.404–421.

Rolland, K.H., Hepsø, V. and Monteiro, E. (2006). Conceptualizing common information spaces across heterogeneous contexts: mutable mobiles and side-effects of integration. In Proceedings of the 2006 20th anniversary conference on Computer supported cooperative work. ACM, pp. 493–500.

Rotondo, F. and Selicato, F. (2012). ICT to evaluate participation in urban planning: remarks from a case study. ***Computational Science and Its Applications–ICCSA 2012***, pp.545–560.

Royal Town Planning Institute. (2014). ***Thinking spatially***. London: RTPI.

Saad-Sulonen, J. (2010a). eParticipation as an information ecology: a micro-scale examination of two cases in Helsinki. In Proceedings of the 22nd Conference of the Computer-Human Interaction Special Interest Group of Australia on Computer-Human Interaction. ACM, pp. 384–387.

Saad-Sulonen, J. (2012). The role of the creation and sharing of digital media content in participatory e-planning. ***International Journal of e-Planning Research (IJEPR)***, 1(2), pp.1–22.

Saad-Sulonen, J. (2010b). The value of Community Informatics to participatory urban planning and design: a case-study in Helsinki. ***The Journal of Community Informatics***, 6(2).

Saldaña, J. (2012). An Introduction to Codes and Coding. In ***The coding manual for*** *qualitative researchers*. SAGE Publications Ltd.

Salganik, M.J. and Levy, K.E.C. (2015). Wiki surveys: Open and quantifiable social data collection. *PLoS ONE*, 10(5).

Seltzer, E. and Mahmoudi, D. (2013). Citizen Participation, Open Innovation, and Crowdsourcing Challenges and Opportunities for Planning. *Journal of Planning Literature*, 28(1), pp.3–18.

Sharp, R. and Rehman, K. (2005). The 2005 UbiApp Workshop: What makes good application-led research? *IEEE Pervasive Computing*, 4(3), pp.80–82.

Shilton, K. (2012). Participatory personal data: An emerging research challenge for the information sciences. *Journal of the American Society for Information Science and Technology*, pp.1905–1915.

Shin, Y. and Shin, D.-H. (2012). Community informatics and the new urbanism: Incorporating information and communication technologies into planning integrated urban communities. *Journal of urban technology*, 19(1), pp.23–42.

Shneiderman, B. (2011). Claiming success, charting the future: micro-HCI and macro-HCI. *interactions*, 18(5), pp.10–11.

Sieber, R. (2006). Public participation geographic information systems: A literature review and framework. *Annals of the Association of American Geographers*, 96(3), pp.491–507.

Simmel, G. (1903). The metropolis and mental life. *The urban sociology reader*, pp.23–31.

Smyth, B. (2013). Small sensors. Big data.

Staffans, A. and Horelli, L. (2014). Expanded Urban Planning as a Vehicle for Understanding and Shaping Smart, Liveable Cities. *The Journal of Community Informatics*, 10(3).

Star, S. and Griesemer, J. (1989). Institutional Ecology,'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907–1939. *Social studies of science*, 19(3), pp.387–420.

Star, S.L. and Ruhleder, K. (1996). Steps toward an ecology of infrastructure: Design and access for large information spaces. *Information Systems Research*, 7(1), pp.111–134.

Steinberg, S. and Steinberg, S. (2006). *Geographic Information Systems for the Social Sciences*. SAGE.

Storz, O. et al. (2006). Public ubiquitous computing systems: Lessons from the e-campus display deployments. *IEEE Pervasive Computing*, 5(3), pp.40–47.

Suchman, L. (2005). Affiliative Objects. ***Organization***, *12*(3), 379–399.

Sun, L. and Vassileva, J. (2006). Social visualization encouraging participation in online communities. ***Groupware: Design, implementation, and use***, pp.349–363.

Surowiecki, J. (2005). ***The Wisdom of Crowds***. Knopf Doubleday Publishing Group.

Swarup, V., Seligman, L. and Rosenthal, A. (2006). A data sharing agreement framework. ***Information Systems Security***, pp.22–36.

Tait, M. (2002). Room for manoeuvre? An actor-network study of central-local relations in development plan making. ***Planning Theory & Practice***, 3(1), pp.69–85.

Talen, E. (2000). Bottom-up GIS: A new tool for individual and group expression in participatory planning. ***Journal of the American Planning Association***, 66(3), pp.279–294.

Taylor, A.S. et al. (2015). Data-in-Place: Thinking through the Relations Between Data and Community. In Proceedings of the 33rd …. pp. 2863–2872.

Tobler, W.R. (1970). A computer movie simulating urban growth in the Detroit region. ***Economic geography***, pp.234–240.

Townsend, A.M. (2000). Life in the real-time city: Mobile telephones and urban metabolism. ***Journal of urban technology***, 7(2), pp.85–104.

Townsend, A.M. (2013). ***Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia***. W. W. Norton & Company.

Turner, A. and Malleson, N. (2012). Applying geographical clustering methods to analyze geo-located open micro-blog posts. In GISRUK 20th Annual Conference.

Voida, A., Yao, Z. and Korn, M. (2015). (Infra)structures of Volunteering. In Proceedings of the 18th ACM Conference on Computer Supported Work & Social Computing. pp. 1704–1716.

Vonk, G., Geertman, S. and Schot, P.P. (2007). A SWOT analysis of planning support systems. ***Environment and Planning A***, 39, pp.1699–1714.

Webber, M.M. (1965). The roles of intelligence systems in urban systems-planning. ***Journal of the American Planning Association***, 31(4), pp.289–296.

Wegener, M., Gnad, F. and Vannahme, M. (1986). The Time Scale of Urban Change.

Weise, S., Hardy, J., Agarwal, P., Coulton, P., Friday, A. and Chiasson, M. (2012a). Democratizing Ubiquitous Computing–a Right for Locality. In 14th ACM International Conference on Ubiquitous Computing.

Weise, S., Hardy, J., Agarwal, P., Coulton, P., Friday, A. and Chiasson, M. (2012b). Fostering off-line interactions through local ubicomp systems: The case of urban development. ***Adjunct proceedings of Ubicomp'12***.

Weiser, M. (1991). The computer for the 21st century. ***Scientific American***, 265(3), pp.94–104.

Whittle, J. et al. (2010). VoiceYourView: collecting real-time feedback on the design of public spaces. In Proceedings of the 12th ACM international conference on Ubiquitous computing. ACM, pp. 41–50.

Williams, A., Robles, E. and Dourish, P. (2009). Urbane-ing the city: Examining and refining the assumptions behind urban informatics. ***Handbook of Research on Urban Informatics: The Practice and Promise of the Real-Time City***, pp.1–20.

Wong, S. and Chua, Y.L. (2001). Data intermediation and beyond: Issues for web-based PPGIS. ***Cartographica: The International Journal for Geographic Information and Geovisualization***, 38(3), pp.63–80.

World Economic Forum. (2012). Rethinking Personal Data: Strengthening Trust. ***World Economic Forum***. [online]. Available from: http://www3.weforum.org/docs/WEF_IT_RethinkingPersonalData_Report_2012.pdf [Accessed May 20, 2012].

Wright, D. et al. (2008). ***Safeguards in a World of Ambient Intelligence***. Springer Science.

Wulf, V. and Rohde, M. (1995). Towardsan Integrated Organization and Technology Development. In DIS '95 Proceedings of the 1st conference on Designing interactive systems: processes, practices, methods, & techniques. pp. 55–64.

Wyatt, P. and Ralphs, M. (2003). ***GIS in Land and Property Management***. Spon Press.

Yin, R.K. (2009). ***Case Study Research: Design and Methods***. 4 ed. SAGE Publications.

Yu, B. and Cai, G. (2009). Facilitating participatory decision-making in local communities through map-based online discussion. ***Proceedings of the fourth international conference on Communities and technologies***, pp.215–224.

Zhang, D. (2011). The Emergence of Social and Community Intelligence. ***Computer***, 44(7), pp.21–28.

Zheng, Y., Yuan, J. and Xie, X. (2011). Urban computing with taxicabs. In Proceedings of the 13th ACM international conference on Ubiquitous computing, Ubicomp.

Zhu, F., Carpenter, S. and Kulkarni, A. (2011). Understanding identity exposure in pervasive computing environments. ***Pervasive and Mobile Computing***, pp.1574–1192.

Zook, M.A. and Graham, M. (2007). Mapping DigiPlace: geocoded Internet data and the representation of place. ***Environment and Planning B: Planning and Design***, 34(3), pp.466–482.

APPENDICES

APPENDIX I provides further detail on the qualitative analysis process for the primary case study (based on thematic analysis). APPENDIX II presents the final coding book as a possible template for future studies in this domain. APPENDIX III shows how study participants in the Lancaster case were linked based on comments left in official consultations. APPENDIX IV provides an analysis of the content of comments made by participants across the participant categorisation applied throughout this work. APPENDIX V provides further detail on the use and development of the primary case study database for the first case study in Lancaster. Finally, APPENDIX VI describes in greater detail the process of developing and applying the interactive interview form that was used for data collection and analysis for the second case study.

APPENDIX I

NOTES ON THE QUALITATIVE ANALYSIS (CASE STUDY IN LANCASTER, UK)

This appendix elaborates on the qualitative analysis process applied to interview transcripts for case study one. Therefore, the notes in this appendix refer to the content in CHAPTER 6. The following sections mentioning the 'analyst', 'researcher', or 'interviewer' interchangeably refer to the individual conducting the qualitative analysis. The following sections will outline the general approach taken to conduct the case analysis, notes on the structure and the content of research interviews, and the stages of the qualitative analysis (coding process). The appendix will highlight the important coding groups and comment on the limitations embedded within my approach.

I.i The case study method

This work primarily drew on the case study method. Case studies were defined as a form of "empirical enquiry that investigates a contemporary phenomenon in depth and within its real-life context [...]" (Yin 2009, p. 18). Yin (2009, p. 101) notes that it is not the goal of case study research to derive statistical generalisations of "populations or universes". Rather, it develops qualified and informed insights, that contribute to the theoretical understanding of the case itself. In a sociological study, variance studies tend to omit the nuances inherent in the contexts of individual research participants. Therefore, case study approaches help to inspect the practical knowledge within a field of enquiry and use those insights to build conceptual and theoretical knowledge (Flyvbjerg 2006). It is these factors that make the case study method complementary to the epistemology of my research, a contextual approach to social science research (Mjøset 2009), since it focuses on the particular rather than the general.

With regard to the data analysis, three degrees of flexibility should be noted:

First, based on the insights gained during the data analysis, amendments to the main research question are encouraged in the contextualist epistemology (Mjøset 2009). The main method of the contextualist approach, the case study, is suitable for highly unstructured problems, when the variables that the study considers, exceed the data points that can be sampled with practical means (Yin 2009, p. 17). The contextualist epistemology in link with the case study method thus encourages an iterative exploration of the problem domain, that gives the researcher the opportunity to revise his or her assumptions and beliefs during the research process (Miles et al. 2014).

Second, case study research generates large volumes of research data (Pettigrew 1990). Naturally only a fraction of that material could be incorporated into the final thesis. Regardless of whether a certain data material was mentioned explicitly in the thesis, working with the data contributed to a good understanding of the key issues within the case study. It offered me a rich picture of the three-year planning process that underlies this case, and provided understanding of the social “mechanisms” (see Langley 2009) how decisions at different points accumulated to changes in the set-up of the ICT facilities used by planners.

Third, the contextualist approach followed via the case study argues that the particularities in my case are valuable contributions to domain knowledge. The value of this research is not in deriving generalisations based on the observed patterns of participation (although some research participants claimed that Lancaster’s processes were fairly “standard” and in line with practices of other local authorities). Based on the rich data gained from case studies, the contextualist approach contributes to grounded middle-level theories as opposed to general ‘laws’.

To make valuable contributions from a case study approach requires a systematic approach in the data analysis that can increase validity and reliability. For the internal validity of the case and to counter the claim of subjectivity in the research, good documentation is essential. As suggested by Yin (2009), a research protocol was kept to document the analysis. Thereby important analytical choices and conclusions can be understood in retrospect. Additionally, in this work, a bespoke relational database helped track interactions with study participants and related archival data.

I.ii Content and structure of the research interviews

As mentioned in CHAPTER 6, 21 participant interviews were conducted with a purposeful sample that included planners (as the core organisers) as well as a set of citizens who participated in official online consultations or public events. In the selection for the study, socio-demographic factors played a minor role. Priority was given to respondent type based on organisational affiliation and location (Lancaster or non-Lancaster) as selection criteria.

By following an interview guide (see Figure 29), each interview was conducted in a similar manner. Table 15 shows that the interviews consisted of three parts supplemented by archival data and visual interview prompts.

PlaceChangers Interview guide (v3 - Jul 2013)

PlaceChangers

Participant details

Name		
Participant number		
Respondent type		
Lancaster resident	yes	no

Known participation pattern

Stage	Scoping consultation (Jun 2010)	Exploring the options (Oct 2011 - Mar 2012)	Developing options consult. (Jun 2011)	Preferred options consultation (Nov 2012)
LA	☐	☐	☐	☐
DMP		☐	☐	☐

Intro: Thanks for your time. Please have a look at the timeline chart provided. The timeline shows a reconstruction of past events related to the preparation of the LA/DMP documents, which are part of the "local plan" for the Lancaster District. For these interviews, please view the plans as a co-developed outcome of a communicative activity between many individuals. In this interview we'll talk about five things related to the survey you filled in. No answer is right or wrong.

For events on the timeline, which you were aware of:	Perceptions of **process** organisation	Perceptions of **information technology**	Perception of your role as **participant**	Perception of **outcomes**
(1) Please tell me about your involvement and what you did. Ideally pointing out concrete events you heard of /attended and **motivations** for participating / non-participating?	(2) What did you think of the **organisation of the document development process**? How did you make sense of it?	(3) How did the **modes of communication** you used (letter/phone/ online/email/face-to-face) help or support you in participating?	(4) What information did you provide & gain? What do you perceive your **role** was in the process?	(5) What do you think about the outcomes of your involvement? Was it "worth it?

Figure 29: Interview guide used during the interview

Prior to the research interviews, personal details were collected via a questionnaire.

The first interview stage focused mainly on building rapport by discussing the background of the interviewee. It was my goal to understand their work history as well as their interests in urban planning in the target area (e.g. Lancaster). The data from this stage was coded using grammatical coding (Miles et al. 2014).

Then in the second stage, the interviewer and interviewee developed a process retrospective view on their participation (Langley and Tsoukas 2010). At that stage, the conversation was supported by archival records on the interviewee's participation in events or online consultation. During the interview, practices such as reviewing a plan document, commenting on a plan document, or communicating with the planners were elaborated. The resulting interview segment was coded with process codes as well as a number of conceptual 'rule' codes (Miles et al. 2014), indicative of the institutional structure of the process.

In the final stage, having gone through the interviewee's participation chronology, the interviewer took the opportunity to asked a few reflective questions that encouraged the interviewee to comment on their role and participation in the plan development in hindsight. This part of the conversation helped to inform a conceptualisation of their mode of participation in the plan development.

Interview stage	Supplementary data & interview technique
1) Participant details	**Supplementary data / interview prompt**: Questionnaire (demographics & general perceptions on past participation in planning in Lancaster) **Analysis technique**: Grammatical coding
2) Narrative of participation	**Visual interview prompt**: Reconstructed process chronology (listing individual participant events from public records) **Supplementary data**: Participant's historic participant in consultations or attendance at planners' events **Interview technique**: Narrative interview using explicit reference to actual events attended by the research participant. **Analysis technique**: Process coding & conceptual coding
3) Synthesis and reflection	**Interview technique**: Summarising reflections **Analysis technique**: Grammatical coding & conceptual coding

Table 15: Each stage in the semi-structured interview with their corresponding interview technique and additional data material

I.iii The mode of interviewing

Due to time and resource constraints, interviews were conducted either in person or on the phone, depending on the travel distance to the participant. The researcher always travelled to the participant where possible but took the liberty of arranging telephone calls where this was impossible (such as with interviewees who did not live within the Lancaster District). Research that applied conversation analysis to telephone and face-to-face interviews described variance between modes of interviews (such as shorter answers on the phone, and the difficulty to build rapport etc.) (Irvine et al. 2012). These effects were avoided as much as possible by the use of an event timeline reconstruction which participants could see on their screen. All remote participants confirmed that they could open and see the timeline. Furthermore, official historic participation records provided sufficient additional prompts for the phone conversations.

I.iv Practicalities of coding interview transcripts

Important for this research was the factual content of the interviews, not so much the form of expression that interviewees used. Hence, denaturalised transcripts[160] were

[160] For this type of transcript, all grammatical and spelling inaccuracies are corrected and non-verbal utterances removed (Oliver et al. 2005).

prepared and imported into Atlas.TI, a qualitative analysis software package to help with the qualitative analysis of the transcripts.

Each transcript was coded in Atlas.TI. A code can be described as "a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and / or evocative attribute for a portion of language-based or visual data" (Saldaña 2012, p. 3). Effectively, codes identify passages in the transcripts that captured the analyst's attention. The task of the analyst is then to re-articulate the salient meaning of the associated passages in the transcript through choosing appropriate code names. According to Saldana et al. (2012), this is done in an "evocative" manner, that on one hand reduces the richness of the data material, while it articulates the analyst's conceptual understanding.

An outline of the coding process is provided in Figure 27. According to Pettigrew et al. (1990), contextualism appreciates that social organisation is an emergent phenomenon. This puts an emphasis on process and context. Hence three coding approaches matched the objectives of this study.

- Grammatical coding (attribute coding): identified all instances of ICT facilities, information artefacts, and events that were known from initial desk study. Grammatical coding helps to structure the information in the transcripts by providing it with a mark-up (whether events, artefacts, information systems/resources, people mentioned).
    - As per Saldana (2006: p.55), "attribute coding is intended as a coding grammar, a way of documenting descriptive 'cover' information about participants, the site, and other related components of the study" and notes that it's applicable to nearly all studies.
- Process coding is a technique to describe action by participants as mentioned in the transcripts. Process codes use gerunds (the grammatical verb form suffixed by 'ing'). All interviews are to be coded with process codes, which makes sense, since the interviews were structured into three parts. Process codes have a dedicated code group indicated by the prefix "PROCESS::" for every process code.
- Perceptual coding captured evaluative statements of participants with regard to their actions as well as the process.

The qualitative analysis software[161] provided a technical framework for the organising and re-organising of the coding scheme (Friese 2012). Atlas.TI offered several ways of doing this by organising the transcript data into document families. For example, transcripts were associated with different categories based on the interviewees' characteristics (e.g. planner or not a planner, male or female, local or not local, organisational contributor or not). Further organisation techniques included the use of code naming practices and code colouring. Towards the end of the first coding phase, less pertinent codes were merged, and overly frequent codes were split to introduce nuance into the analysis.

In the second coding stage, the important interview transcripts (including planners, and key participants) were coded a second time. Atlas.TI offered the functionality to work with code-to-code relations (network building). During conceptual coding, network graphs of codes and the option to hyper-link codes became useful to refine existing code dimensions by comparing and contrasting existing codes. Figure 30 below indicates the general coding steps for the coding process.

Through this process, the overall code list shrank from 807 codes in October 2013 to 593 codes in December 2013.

[161] Atlas.TI was used throughout this study.

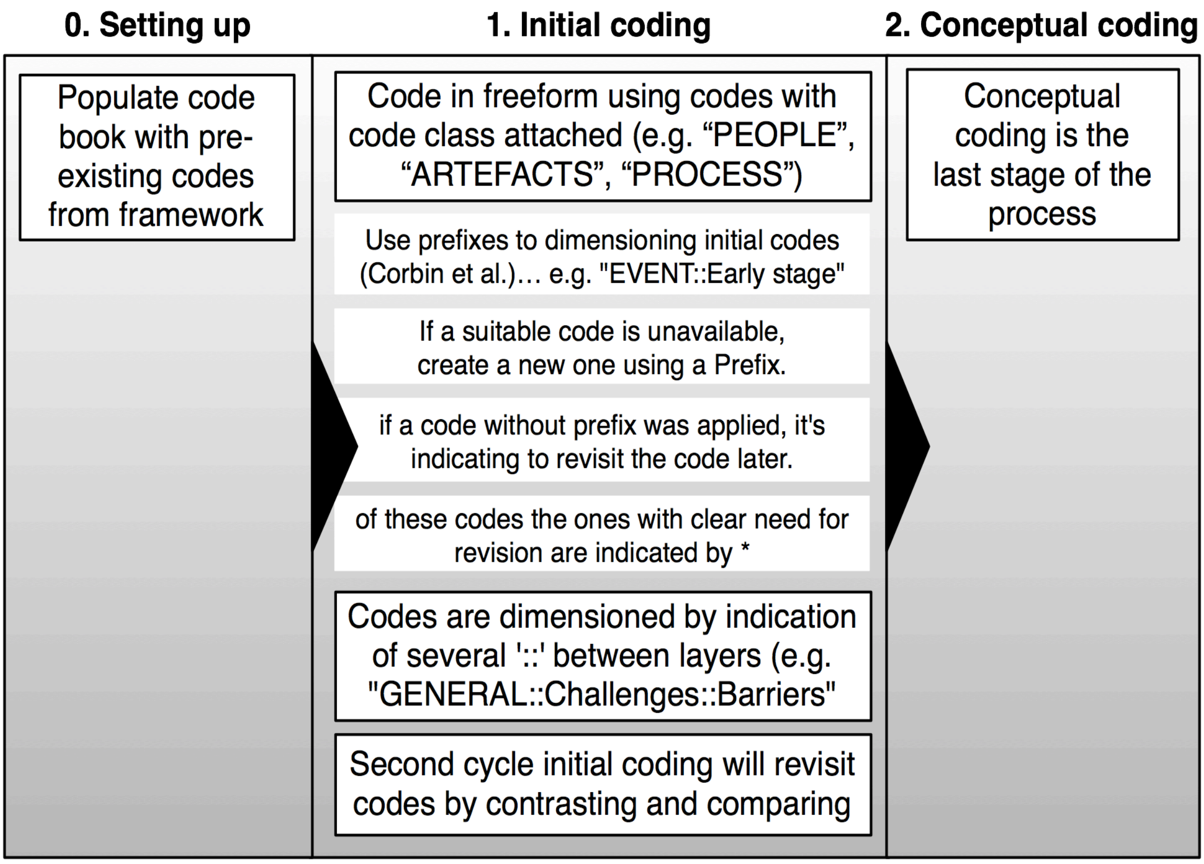


Figure 30: A simplified overview of the coding process. The figure shows the steps to organise codes by use of code naming policies.

I.v Important coding groups

At times, the code book included a great number of codes. It does not however mean that all these codes were of equal importance. A theoretical framework is useful to bound the qualitative analysis (Yin 2009). The framework that underlies this analysis, described in CHAPTER 4, helped to organise the analysis of the socio-technical system described in study one. To organise codes and develop conclusions, memo writing was essential but also the organisation of codes into code groups and sub-codes. In the process, Table 16 below shows the most pertinent coding groups that were used within the analysis.

These coding classes could be coded simultaneously for the description of an instance of interaction that the participant remembered (for example, the experience of submitting a document X via ICT facility Y in association with event W).

Code class	Applied when	Type
EVENT::	Any instances of events that are documented (in archival data) or alternatively mentioned by study participant. There are more specific events (one offs and particular instances) or more general ones (early stage of process). These codes provide a time dimension.	Grammatical codes
ARTEFACT::	Similar to the EVENT class, the ARTEFACT class was applied to segments that refer to an information object. For example, it was applicable to any documents that were mentioned but also specific parts of documents which have some informative function (such as a timeline).	Grammatical codes
ICT-FACILITIES::	Any instances of ICT that were mentioned in an identifiable, unambiguous way (for example, city council website, planning portal, mapping platform).	Grammatical codes
PLACE::	Similar to the EVENT class, the PLACE class applied were there is anything mentioned in reference to a place.	Grammatical codes
PARTICIPANT::	Any attributes of a particular study participant. This class is a grammatical code class. It is important since this study in particular focuses on individual participants as case studies in the wider case study.	Grammatical codes
PROCESS::	PROCESS codes are ideally applied when the participant did some action or had an interaction with another person or object. I think usually PROCESS codes are more general, but here they should ideally apply to one particular person.	Process codes; conceptualised codes
RULES::	RULE codes were derived from the theoretical framework employed for the work. These were thus induced codes.	Conceptualised codes

Table 16: Pertinent coding groups

Please see APPENDIX II for a detailed list of codes for each of these code classes.

I.vi Weaknesses and limitations

Case studies, and more generally qualitative research, have to face critiques of being subjective. Yin (2009) suggested that this can be answered by transparency of how the study was conducted. This paradigm of transparency extends to the process of coding within qualitative analysis that represents a skilful manual intervention into the analysis process by a capable analyst. I fully accept the critique that coding in itself could introduce a bias. Qualitative research often assumes that research is seldom neutral or fully objective. Choices taken by the analyst with regard to the project focus and goals, the exact methods and final publications are usually taken by informed decision- making.

The strength of the coding process could have been furthered by employing a second coder, to apply the same coding framework onto the original dataset. While this was infeasible in this study due to time and resource limitations, it is certainly an option worthwhile to consider for future research in this field.

Nevertheless, this study employed many means to increase accuracy of the data, such as a rich repository of existing archival data, a timeline reconstruction based on this existing data, awareness of interview participants' historic instances of participation. The case study followed the guidelines set out by Yin (2009) with regard to data triangulation.

APPENDIX II

CODE BOOK (CASE STUDY IN LANCASTER, UK)

CODE CLASS	CODE NAME
ARTEFACTS	ARTEFACTS::Boundary::Big empty canvas
ARTEFACTS	ARTEFACTS::Boundary::Representation form
ARTEFACTS	ARTEFACTS::Boundary::Rural engagement questionnaire
ARTEFACTS	ARTEFACTS::Boundary::Template for PPCLG
ARTEFACTS	ARTEFACTS::Comm::Briefing presentation
ARTEFACTS	ARTEFACTS::Comm::Email "diary updates"
ARTEFACTS	ARTEFACTS::Comm::Postal mail outs
ARTEFACTS	ARTEFACTS::Contributions (textual)
ARTEFACTS	ARTEFACTS::Coord::LDS
ARTEFACTS	ARTEFACTS::Coord::Timeline*
ARTEFACTS	ARTEFACTS::Coordinatory artefact
ARTEFACTS	ARTEFACTS::Evidence::Evidence base
ARTEFACTS	ARTEFACTS::Evidence::Site portfolio
ARTEFACTS	ARTEFACTS::Images
ARTEFACTS	ARTEFACTS::Index & doc summaries
ARTEFACTS	ARTEFACTS::Maps::District maps (in events)
ARTEFACTS	ARTEFACTS::Maps::Proposals map (in documents)
ARTEFACTS	ARTEFACTS::Maps::Proposals map (online)
ARTEFACTS	ARTEFACTS::PD::Combined scoping doc
ARTEFACTS	ARTEFACTS::PD::Development management DPD
ARTEFACTS	ARTEFACTS::PD::Land Allocations DPD
ARTEFACTS	ARTEFACTS::Plan docs
ARTEFACTS	ARTEFACTS::Process docs::Consultation statement
ARTEFACTS	ARTEFACTS::Process docs::Contribution reports (Events & consultations)
ARTEFACTS	ARTEFACTS::Process docs::Contribution reports (internal)
ARTEFACTS	ARTEFACTS::Process docs::SCI
ARTEFACTS	ARTEFACTS::Steer::Guide for commenting (pub stage)
ARTEFACTS	ARTEFACTS::Steer::Listing of site constraints

ARTEFACTS	ARTEFACTS::Steer::NPPF
CHALLENGES	Challenges::(Mis-)interpretation of comment contributions, managing expectations of different publics
CHALLENGES	Challenges::Changing policy context (~NPPF)
CHALLENGES	Challenges::Complex information space (changing doc names, ambiguous stage names, myriads of documents, massive evidence basis)
CHALLENGES	Challenges::Conceptual, not happening now, not happening down the street
CHALLENGES	Challenges::Consultation fatigue, easy to drift away w/o specific interest
CHALLENGES	Challenges::Developing compelling evidence-based, impersonal arguments
CHALLENGES	Challenges::Enormously slow process, risk to be overtaken by economic changes
CHALLENGES	Challenges::Establishing relevant content, making process digestible
CHALLENGES	Challenges::Getting a feel for future site allocations (particularly at earlier stages)
CHALLENGES	Challenges::Handling planning responsibilities with few staff
CHALLENGES	Challenges::ICT facility too complicated to use (registering, commenting)
CHALLENGES	Challenges::Identifying relevant policies almost requires a having a degree
CHALLENGES	Challenges::Inaccessible, dry, boring language and terminology
CHALLENGES	Challenges::Influencing plans beyond small tweaks impossible
CHALLENGES	Challenges::Insufficient feedback on comment's impact
CHALLENGES	Challenges::Making planning important role understood
CHALLENGES	Challenges::Managing process while keeping evidence up to date
CHALLENGES	Challenges::Reaching beyond circle of active participants
CHALLENGES	Challenges::Reconciling conflicting agendas, making collective choices
CHALLENGES	Challenges::Responding to consultations concurrently
CHALLENGES	Challenges::Structured forms consume time, online commenting less enjoyable
CHALLENGES	Challenges::Thinking beyond personal interests, preparing something for the district
CHALLENGES	Challenges::Time and place of events
CHALLENGES	Challenges::Time requirements for interacting with long & complicated documents
CHALLENGES	Challenges::Uncomfortable to read long, static documents online
CHALLENGES	Challenges::Uncontrolled commenting
CHALLENGES	Challenges::Underdeveloped outcome reports, incomprehensible who said what
CHALLENGES	Challenges::Understanding and constructively challenging planning targets (& "evidence")
EVENTS	EVENT::Business breakfast/afternoon

EVENTS	EVENT::Calling the sites exercise [2009]
EVENTS	EVENT::Carnforth town meeting [Apr 2011]
EVENTS	EVENT::CS consultation [summer 2010]
EVENTS	EVENT::CS::Economic thematic group
EVENTS	EVENT::CS::Sustainability partnership
EVENTS	EVENT::Developing Options consultation stage
EVENTS	EVENT::Developing Options consultation::After consultation close
EVENTS	EVENT::Developing Options consultation::General info events
EVENTS	EVENT::DPD consultation event (Carnforth Town Hall)
EVENTS	EVENT::DPD consultation event (Parish Council Forum)
EVENTS	EVENT::Early phase of plan dev [CS & EO stages]
EVENTS	EVENT::EO stage [winter 2010]
EVENTS	EVENT::EO::After stage concluded
EVENTS	EVENT::EO::Rural engagement [winter 2010]
EVENTS	EVENT::EO::Spatial planning workshops (general)
EVENTS	EVENT::EO::Thematic workshop - green infrastructure
EVENTS	EVENT::EO::Thematic workshop - meeting future dev needs
EVENTS	EVENT::EO::Thematic workshop - Renewables and Energy
EVENTS	EVENT::EO::Thematic workshop - sustainable transport
EVENTS	EVENT::EO::Thematic workshops (general)
EVENTS	EVENT::Extraordinary town council meeting (Carnforth) [Jul 2011]
EVENTS	EVENT::Final phase [>2013]
EVENTS	EVENT::Final phase::Addendum consultation for LA (upcoming)
EVENTS	EVENT::Final phase::Publication stage
EVENTS	EVENT::Full council meeting [11th Sep 2012]
EVENTS	EVENT::Full council meeting [18th July 2012]
EVENTS	EVENT::General information events
EVENTS	EVENT::Internal Officer meeting [Oct 2010]
EVENTS	EVENT::Later phase of plan development (Dev options onwards)
EVENTS	EVENT::Meeting with Natural England (Dec 2012)
EVENTS	EVENT::Meetings with DM team [~Apr 2011]
EVENTS	EVENT::Period DO --> PO
EVENTS	EVENT::Period EO --> DO

EVENTS	EVENT::Preferred Options consultation::After consultation
EVENTS	EVENT::Preferred Options consultation::Prior to consultation
EVENTS	EVENT::Preferred Options stage
EVENTS	EVENT::Preferred Options stage::General info events
EVENTS	EVENT::Preferred Options stage::Outcome [~Mar 2013]
EVENTS	EVENT::Regular officer meetings
EVENTS	EVENT::Sunday-lecture (public talk)
EXTERNAL SYSTEM CONSTRAINT	External system constraint::External service provider
EXTERNAL SYSTEM CONSTRAINT	External system constraint::Laws::Evidence requirements
EXTERNAL SYSTEM CONSTRAINT	External system constraint::Laws::Info & process requirement
EXTERNAL SYSTEM CONSTRAINT	External system constraint::National policies
EXTERNAL SYSTEM CONSTRAINT	External system constraint::National Policies::Housing targets
FACILITY	FACILITY::Archive (emails)
FACILITY	FACILITY::Authoring software (MS Word) [council]
FACILITY	FACILITY::Bespoke database [contributor]
FACILITY	FACILITY::Calendaring
FACILITY	FACILITY::Email database::Individual
FACILITY	FACILITY::General*
FACILITY	FACILITY::Inbox (emails, shared, organisers)
FACILITY	FACILITY::Inbox (physical / document tray)
FACILITY	FACILITY::Inbox (various channels)
FACILITY	FACILITY::Inbox::Shared email address
FACILITY	FACILITY::Local media (blogs & newspapers)
FACILITY	FACILITY::Mapping system [contributor]
FACILITY	FACILITY::Mapping system [council]
FACILITY	FACILITY::Newsletter (third party)
FACILITY	FACILITY::Newsletter::Community group
FACILITY	FACILITY::Newsletter::Parish council clerks
FACILITY	FACILITY::Newsletter::Planning policy (email)
FACILITY	FACILITY::Online publisher (council / third party)

FACILITY	FACILITY::Paperless office system (Anite) [council]
FACILITY	FACILITY::Paperless office system (bespoke) [contributor]
FACILITY	FACILITY::Planning portal (Objective system)
FACILITY	FACILITY::Planning portal::Contacts database
FACILITY	FACILITY::Planning support software (IDOX uniform)
FACILITY	FACILITY::Shared drive (contributor)
FACILITY	FACILITY::Shared drive [council]
FACILITY	FACILITY::Social media (council)
FACILITY	FACILITY::Website [planners]
INTERNAL SYSTEM CONSTRAINT	Internal system constraints::Channels of communication
INTERNAL SYSTEM CONSTRAINT	Internal system constraints::Community involvement (SCI)
INTERNAL SYSTEM CONSTRAINT	Internal system constraints::Deadlines and milestones
INTERNAL SYSTEM CONSTRAINT	Internal system constraints::Fixed time schedules of formal review meetings
INTERNAL SYSTEM CONSTRAINT	Internal system constraints::Lead times
INTERNAL SYSTEM CONSTRAINT	Internal system constraints::Limited internal discussion
INTERNAL SYSTEM CONSTRAINT	Internal system constraints::Man power
INTERNAL SYSTEM CONSTRAINT	Internal system constraints::Planners' judgements
INTERNAL SYSTEM CONSTRAINT	Internal system constraints::Processing time for comments
INTERNAL SYSTEM CONSTRAINT	Internal system constraints::Summarising long comments
INTERNAL SYSTEM CONSTRAINT	Internal system constraints::Time to process hard copy comments
OPPORTUNITIES	Opportunities::Artefacts::Document and final summaries
OPPORTUNITIES	Opportunities::Artefacts::Examples of policy implication
OPPORTUNITIES	Opportunities::Artefacts::Mapping
OPPORTUNITIES	Opportunities::Artefacts::Timeline representation
OPPORTUNITIES	Opportunities::Artefacts::Use of photo media
OPPORTUNITIES	Opportunities::Electronic communication to reduce processing time

OPPORTUNITIES	Opportunities::Explaining external system constraints
OPPORTUNITIES	Opportunities::More efficient process
OPPORTUNITIES	Opportunities::More interactive modes of participation
OPPORTUNITIES	Opportunities::More research
OPPORTUNITIES	Opportunities::Pro-active engagement
PARTICIPANT	PARTICIPANT::Demo::Age
PARTICIPANT	PARTICIPANT::Demo::Employment status
PARTICIPANT	PARTICIPANT::Demo::Gender
PARTICIPANT	PARTICIPANT::Demo::Participant ID
PARTICIPANT	PARTICIPANT::Education::level
PARTICIPANT	PARTICIPANT::Educational::background
PARTICIPANT	PARTICIPANT::Geo::Primary location
PARTICIPANT	PARTICIPANT::Geo::Relation to Lancaster
PARTICIPANT	PARTICIPANT::Geo::Years at primary location
PARTICIPANT	PARTICIPANT::Job role
PARTICIPANT	PARTICIPANT::Job role::"Patch"/geographic focus
PARTICIPANT	PARTICIPANT::Job role::ICT use
PARTICIPANT	PARTICIPANT::Job role::Main responsibilities (process)
PARTICIPANT	PARTICIPANT::Knowledge::Local knowledge (people)
PARTICIPANT	PARTICIPANT::Knowledge::Local knowledge (places)
PARTICIPANT	PARTICIPANT::Knowledge::Personal (expert) knowledge
PARTICIPANT	PARTICIPANT::Knowledge::Process knowledge
PARTICIPANT	PARTICIPANT::Knowledge::Professional expertise (in planning)
PARTICIPANT	PARTICIPANT::Motivation::Being formally recorded
PARTICIPANT	PARTICIPANT::Motivation::Being paid
PARTICIPANT	PARTICIPANT::Motivation::Development interest
PARTICIPANT	PARTICIPANT::Motivation::Having a better policy
PARTICIPANT	PARTICIPANT::Motivation::Knowing about sites
PARTICIPANT	PARTICIPANT::Motivation::Meeting organisers (i.e. planners)
PARTICIPANT	PARTICIPANT::Motivation::Protecting land
PARTICIPANT	PARTICIPANT::Motivation::Representing others
PARTICIPANT	PARTICIPANT::Motivation::Success of business & property value
PARTICIPANT	PARTICIPANT::Motivation::Success of Lancaster

PARTICIPANT	PARTICIPANT::Motivation::Supporting council
PARTICIPANT	PARTICIPANT::Occupation::Current
PARTICIPANT	PARTICIPANT::Occupation::Past
PARTICIPANT	PARTICIPANT::Occupation::Years in
PARTICIPANT	PARTICIPANT::Other additional commitments
PARTICIPANT	PARTICIPANT::Other additional commitments::Past
PARTICIPANT	PARTICIPANT::Process::Awareness of
PARTICIPANT	PARTICIPANT::Process::Key issue / interest
PARTICIPANT	PARTICIPANT::Process::Role
PARTICIPANT	PARTICIPANT::Process::Role::Aggregator
PARTICIPANT	PARTICIPANT::Process::Role::Intermediary
PARTICIPANT	PARTICIPANT::Process::Role::Overseeing
PARTICIPANT	PARTICIPANT::Process::Role::Passive
PARTICIPANT	PARTICIPANT::Process::Role::Representative
PARTICIPANT	PARTICIPANT::Process::Role::Reviewer
PARTICIPANT	PARTICIPANT::Resources::Bank of professionals
PARTICIPANT	PARTICIPANT::Resources::Guidelines
PARTICIPANT	PARTICIPANT::Resources::Internal databases
PARTICIPANT	PARTICIPANT::Resources::Professional environment
PARTICIPANT	PARTICIPANT::Resources::Site managers
PEOPLE	PEOPLE::Attendees::General info events
PEOPLE	PEOPLE::Attendees::Participants in an event
PEOPLE	PEOPLE::Contributors::Consultees abroad
PEOPLE	PEOPLE::Contributors::Developers
PEOPLE	PEOPLE::Contributors::Members of the public
PEOPLE	PEOPLE::Contributors::Passive audience
PEOPLE	PEOPLE::Contributors::Planning consultants
PEOPLE	PEOPLE::Contributors::Previous consultees
PEOPLE	PEOPLE::Contributors::Professional consultees
PEOPLE	PEOPLE::Contributors::Special interest groups
PEOPLE	PEOPLE::Contributors::Statutory consultees
PEOPLE	PEOPLE::External planning consultants
PEOPLE	PEOPLE::Lancashire county council

PEOPLE	PEOPLE::LCC
PEOPLE	PEOPLE::LCC::City councillors
PEOPLE	PEOPLE::LCC::Council cabinet
PEOPLE	PEOPLE::LCC::DM team
PEOPLE	PEOPLE::LCC::Full council
PEOPLE	PEOPLE::LCC::Other officers
PEOPLE	PEOPLE::LCC::Participants [internal meeting]
PEOPLE	PEOPLE::LCC::Planning committee
PEOPLE	PEOPLE::LCC::PPCLG
PEOPLE	PEOPLE::Local authorities in UK
PEOPLE	PEOPLE::Other::Chamber of Commerce
PEOPLE	PEOPLE::Other::Client
PEOPLE	PEOPLE::Other::Local community group(s)
PEOPLE	PEOPLE::Other::Locally-based staff
PEOPLE	PEOPLE::Other::Michael Gilbert (Peter Brett Associates)
PEOPLE	PEOPLE::Other::Planning volunteer
PEOPLE	PEOPLE::Other::Print & media design company
PEOPLE	PEOPLE::Parish councils [Lancs]
PEOPLE	PEOPLE::Parish councils::Carnforth councillors
PEOPLE	PEOPLE::Parish councils::Clerks
PEOPLE	PEOPLE::Planners
PEOPLE	PEOPLE::Planners::D Haywood
PEOPLE	PEOPLE::Planners::D Jeffrey
PEOPLE	PEOPLE::Planners::D Porter
PEOPLE	PEOPLE::Planners::K Brown
PEOPLE	PEOPLE::Planners::M Brophy
PEOPLE	PEOPLE::Planners::Michelle
PEOPLE	PEOPLE::Planners::P Hatch
PEOPLE	PEOPLE::Planners::Project group*
PEOPLE	PEOPLE::Planners::R Richards
PEOPLE	PEOPLE::Primary participants
PEOPLE	PEOPLE::Primary participants::Council
PEOPLE	PEOPLE::Primary participants::Older demographic

PEOPLE	PEOPLE::Reviewers::Planning inspector
PLACE	PLACE::ANOB
PLACE	PLACE::Canal Corridor site
PLACE	PLACE::Carnforth
PLACE	PLACE::Freeman's Wood
PLACE	PLACE::Grab lane site
PLACE	PLACE::Lancashire
PLACE	PLACE::Lancaster centre & Skerton
PLACE	PLACE::Lancaster::District
PLACE	PLACE::Lancaster::East
PLACE	PLACE::Lancaster::South
PLACE	PLACE::Lune site
PLACE	PLACE::Manchester
PLACE	PLACE::Marsh
PLACE	PLACE::Silverdale & Hornby
PLACE	PLACE::Warton
PROCESS	PROCESS::Accessing::Attending event with planners
PROCESS	PROCESS::Accessing::Deciding not to contribute
PROCESS	PROCESS::Accessing::Discovering upcoming plan consultation (self-search)
PROCESS	PROCESS::Accessing::Downloading plan documents
PROCESS	PROCESS::Accessing::Finding plan documents online ***
PROCESS	PROCESS::Accessing::Getting involved initially
PROCESS	PROCESS::Accessing::Learning about process in public meeting
PROCESS	PROCESS::Accessing::Learning how to contribute from planners
PROCESS	PROCESS::Accessing::Noticing process via local press
PROCESS	PROCESS::Accessing::Receiving briefing from planners
PROCESS	PROCESS::Accessing::Receiving confirmation
PROCESS	PROCESS::Accessing::Receiving information from planners
PROCESS	PROCESS::Accessing::Receiving information via different route
PROCESS	PROCESS::Accessing::Receiving invite for closed event
PROCESS	PROCESS::Accessing::Receiving notifications & updates [planners]
PROCESS	PROCESS::Accessing::Understanding goals and objectives
PROCESS	PROCESS::Accessing::Watching process / waiting to interact

PROCESS	PROCESS::Collecting contributions
PROCESS	PROCESS::Collecting contributions [informal]
PROCESS	PROCESS::Collecting informal feedback [in team]
PROCESS	PROCESS::Collecting input [other officers]
PROCESS	PROCESS::Contributing::Asking client for further comments
PROCESS	PROCESS::Contributing::Collecting feedback for making contribution
PROCESS	PROCESS::Contributing::Commenting on behalf of a group
PROCESS	PROCESS::Contributing::Coordinating formal responses
PROCESS	PROCESS::Contributing::Drafting a formal response
PROCESS	PROCESS::Contributing::Drawing on paid-for specialist
PROCESS	PROCESS::Contributing::Obtaining approval for formal contribution
PROCESS	PROCESS::Contributing::Reviewing organisational response
PROCESS	PROCESS::Contributing::Sharing expertise in a meeting
PROCESS	PROCESS::Contributing::Submitting comments (various channels)
PROCESS	PROCESS::Documenting::Preparing a process document
PROCESS	PROCESS::Documenting::Publishing document online after approval
PROCESS	PROCESS::Documenting::Summarising [event outcome]
PROCESS	PROCESS::Evaluating sites
PROCESS	PROCESS::Evaluating survey
PROCESS	PROCESS::Evaluating::Deferring decision on complex contributions
PROCESS	PROCESS::Evaluating::Discussing 'grey comments'
PROCESS	PROCESS::Evaluating::Evaluating contributions
PROCESS	PROCESS::Evaluating::Responding to contributions
PROCESS	PROCESS::Informing::Engaging with the press
PROCESS	PROCESS::Informing::Organising briefing presentations
PROCESS	PROCESS::Informing::Organising outreach events
PROCESS	PROCESS::Informing::Raising awareness
PROCESS	PROCESS::Informing::Sending emails to consultee database
PROCESS	PROCESS::Informing::Sending note of thanks to contributors
PROCESS	PROCESS::Involving::Engaging internal end user of plan document
PROCESS	PROCESS::Involving::Giving briefing presentations
PROCESS	PROCESS::Involving::Making links with people
PROCESS	PROCESS::Involving::Raising awareness for process

PROCESS	PROCESS::Involving::Sending forms to parish councils (questionnaires)
PROCESS	PROCESS::Maintaining::Consultee database
PROCESS	PROCESS::Maintaining::Sites portfolio
PROCESS	PROCESS::Maintaining::website
PROCESS	PROCESS::Making sense of council's direction
PROCESS	PROCESS::Making sense of local area::Looking up a district map
PROCESS	PROCESS::Making sense of local area::Visiting Lancaster
PROCESS	PROCESS::Making sense of local issues
PROCESS	PROCESS::Making sense of participation
PROCESS	PROCESS::Making sense::Comparing organiser's response patterns
PROCESS	PROCESS::Making sense::Picking out key themes from contributions
PROCESS	PROCESS::Making sense::process
PROCESS	PROCESS::Making sense::Process history
PROCESS	PROCESS::Mediating::Collating information for an internal report
PROCESS	PROCESS::Mediating::Discussing sites in official meeting
PROCESS	PROCESS::Mediating::Filtering information for others
PROCESS	PROCESS::Mediating::Informing others
PROCESS	PROCESS::Mediating::Notifying client [incl. head office] of process
PROCESS	PROCESS::Mediating::Organising a closed meeting
PROCESS	PROCESS::Mediating::Preparing information for a response*
PROCESS	PROCESS::Mediating::Representing client
PROCESS	PROCESS::Meta communicating::Clarifying and responding to questions
PROCESS	PROCESS::Meta communicating::Collecting expert feedback informally [from contributors]
PROCESS	PROCESS::Meta communicating::Discussing issues in closed meeting
PROCESS	PROCESS::Meta communicating::Discussing with peers
PROCESS	PROCESS::Meta communicating::Maintaining regular dialogue
PROCESS	PROCESS::Meta communicating::Meeting contributors to discuss comment
PROCESS	PROCESS::Meta communicating::Meeting organisers (i.e. planners)
PROCESS	PROCESS::Meta communicating::Meeting statutory consultees [prior to consultation]
PROCESS	PROCESS::Meta communicating::Meeting with internal end user of plan document
PROCESS	PROCESS::Meta communicating::Obtaining approval from other officers
PROCESS	PROCESS::Meta communicating::Receiving meeting request from planners

PROCESS	PROCESS::Meta communicating::Receiving preliminary documents via email directly
PROCESS	PROCESS::Meta communicating::Receiving request regarding a contribution
PROCESS	PROCESS::Meta communication::Discussing issues with other collaborators
PROCESS	PROCESS::Meta-communicating::Contacting organisers (i.e. planners)
PROCESS	PROCESS::Meta-communicating::Discussing policy document with non-policy officer
PROCESS	PROCESS::Meta-communicating::Having on-going discussions with objectors
PROCESS	PROCESS::Meta-communicating::Meeting planners informally
PROCESS	PROCESS::Monitoring::Generating automatic reports
PROCESS	PROCESS::Monitoring::Making sense of contributors
PROCESS	PROCESS::Monitoring::Monitoring passive readership
PROCESS	PROCESS::Monitoring::Observing a meeting
PROCESS	PROCESS::Organising::Archiving consultation responses
PROCESS	PROCESS::Organising::Changing responsibilities
PROCESS	PROCESS::Organising::Creating a response table
PROCESS	PROCESS::Organising::Creating information material
PROCESS	PROCESS::Organising::Creating maps for events
PROCESS	PROCESS::Organising::Deciding IS changes
PROCESS	PROCESS::Organising::Designing a survey
PROCESS	PROCESS::Organising::Documenting and reflecting on the process
PROCESS	PROCESS::Organising::Establishing a Facebook account
PROCESS	PROCESS::Organising::Focusing on general info events
PROCESS	PROCESS::Organising::Inviting select participants for event
PROCESS	PROCESS::Organising::Keeping overview
PROCESS	PROCESS::Organising::Learning from past experience
PROCESS	PROCESS::Organising::Linking different ICT tools
PROCESS	PROCESS::Organising::Planning upcoming consultation arrangements
PROCESS	PROCESS::Organising::Prioritizing key parish councils
PROCESS	PROCESS::Organising::Repeating a consultation stage
PROCESS	PROCESS::Organising::Seeking more time to explore an issue
PROCESS	PROCESS::Organising::Selecting engagement methods
PROCESS	PROCESS::Organising::Split document development processes
PROCESS	PROCESS::Organising::Steering contributions

PROCESS	PROCESS::Organising::Suggesting all possible sites for feedback
PROCESS	PROCESS::Organising::Taking ultimate responsibility
PROCESS	PROCESS::Prioritising::Allocating sites in a workshop
PROCESS	PROCESS::Prioritising::Commenting on principle outcomes
PROCESS	PROCESS::Prioritizing::Discussing debateable sites last
PROCESS	PROCESS::Prioritizing::Discussing issues in workshop setting
PROCESS	PROCESS::Reading::Evaluating policies
PROCESS	PROCESS::Reading::Filtering information (In-set map)
PROCESS	PROCESS::Reading::Filtering information (Topical section)
PROCESS	PROCESS::Reading::Making sense of plan documents
PROCESS	PROCESS::Reading::Reading a specific policy
PROCESS	PROCESS::Reading::Reviewing a plan document
PROCESS	PROCESS::Receiving an update on progress
PROCESS	PROCESS::Receiving complaints about missing leaflets
PROCESS	PROCESS::Receiving contributions (various channels)***
PROCESS	PROCESS::Receiving::Checking comments in Objective
PROCESS	PROCESS::Receiving::Inputting comments into Objective (various channels)
PROCESS	PROCESS::Receiving::Inputting postal contributions
PROCESS	PROCESS::Receiving::Piling comments from letter/response in physical inbox
PROCESS	PROCESS::Receiving::Receiving contributions from parish councils (questionnaire)
PROCESS	PROCESS::Reviewing impact::Informal meeting
PROCESS	PROCESS::Reviewing impact::Noticing other contributors
PROCESS	PROCESS::Reviewing impact::Reading a process document
PROCESS	PROCESS::Reviewing impact::Reading between the lines
PROCESS	PROCESS::Reviewing impact::Responding to officers comments
PROCESS	PROCESS::Reviewing underlying evidence
PROCESS	PROCESS::Reviewing::Attending a formal council meeting
PROCESS	PROCESS::Reviewing::Keeping internal reviewer informed
PROCESS	PROCESS::Reviewing::Obtaining approval for draft documents
PROCESS	PROCESS::Reviewing::Reporting progress to institutional review board
PROCESS	PROCESS::Reviewing::Reviewing the process (PPCLG)
PROCESS	PROCESS::Seeing site allocations visually
PROCESS	PROCESS::Sharing outcome during a workshop

PROCESS	PROCESS::Sourcing expertise within organisation
PROCESS	PROCESS::Structuring::Authoring plan documents
PROCESS	PROCESS::Structuring::Developing broad conclusions
PROCESS	PROCESS::Structuring::Developing objectives
PROCESS	PROCESS::Structuring::Facilitating common understanding of constraints
PROCESS	PROCESS::Structuring::Forming small groups
PROCESS	PROCESS::Structuring::Providing an initial view
PROCESS	PROCESS::Structuring::Providing information on constraints
PROCESS	PROCESS::Structuring::Referencing contributions
PROCESS	PROCESS::Structuring::Refining plan documents
PROCESS	PROCESS::Structuring::Responding to change in constitutional rule
PROCESS	PROCESS::Structuring::Setting out a general approach
PROCESS	PROCESS::Structuring::Structuring a plan document
PROCESS	PROCESS::Structuring::Using game to soliciting opinion on sites
PROCESS	PROCESS::Summarising [collection of contributions]
PROCESS	PROCESS::Summarising [multiple process documents]
PROCESS	PROCESS::Summarising [separate contributions]
RULES	PROCESS::Using map/form to contribute [workshops]
RULES	RULES (deducted)
RULES	RULES::Access
RULES	RULES::Access::Participant selection
RULES	RULES::Aggregating
RULES	RULES::Aggregating::Impact not a function of number of people
RULES	RULES::Aggregating::Outcomes for evaluating contributions
RULES	RULES::Authority
RULES	RULES::Choice
RULES	RULES::Choice::Contributing
RULES	RULES::Criteria/Rules to judge content
RULES	RULES::Criteria/rules to judge engagement ('important to engage early')
RULES	RULES::Criteria/Rules to judge method
RULES	RULES::Criteria/Rules to judge site
RULES	RULES::Exercise
RULES	RULES::Informing

RULES	RULES::Legal requirements & "good practice"
RULES	RULES::Position
RULES	RULES::Scope

APPENDIX III

ANALYTICAL NOTE ON THE LINKS AMONG PARTICIPANTS IN THE FIRST CASE STUDY (LANCASTER)

The table below gives an overview of the participants included in the Lancaster case.

Participant	Demographics	Educational level	Contributor type	Mode
Lancaster				
Ruby Lawrence	m - 40-64	PhD	Special interest	face-to-face
Charlie Herring	m - 15-39	Bachelors	Other business	face-to-face
Jack Finnan	m - 40-64	A-levels	Other business	face-to-face
Amelia Chambers	f - 40-64	Masters	Government	face-to-face
Daniel Sampling	m - 40-64	PhD	Government	face-to-face
Amelia Arrowhead	f - 40-64	PhD	Special interest	face-to-face
Sophie Leather	f - 40-64	A-levels	Special interest	face-to-face
Daniel Simpson	m - 15-39	Bachelors	Special interest	face-to-face
Thomas Havildar	m - 40-64	Other post-graduate	Government	telephone
Non-Lancaster				
Chloe Ryan	f - 15-39	Masters	Business focused on development	telephone
Emily Bailey	f - 15-39	Bachelors	Government	telephone
Jack Darter	m - 40-64	Bachelors	Special interest	telephone
Ella Williams	f - 15-39	Other post-graduate	Government	telephone
Daniel Rogers	m - 15-39	Masters	Business focused on development	telephone
William Lane	m - 15-39	Masters	Business focused on development	telephone
Thomas Fletcher	m - 40-64	Other post-graduate	Business focused on development	face-to-face

Figure 31: Overview of interview participants for the first case study (study 1)

The flowchart (Figure 32) traces all their known interactions based on archival data. The dimension "channel of communication" is a proxy for the online facilities participants were drawing on. In this case, the 'web' implies the use of the online commenting facility implying related constraints of having to register before being able to contribute and being constrained to the forms offered by the online system. The rightmost dimension represents the four previously introduced phases of participation to which the operational rules listed in Table 10 apply. The heavy use of email-based contributing becomes apparent through the width of the respective flows which are determined by the number of known comments or event attendance.

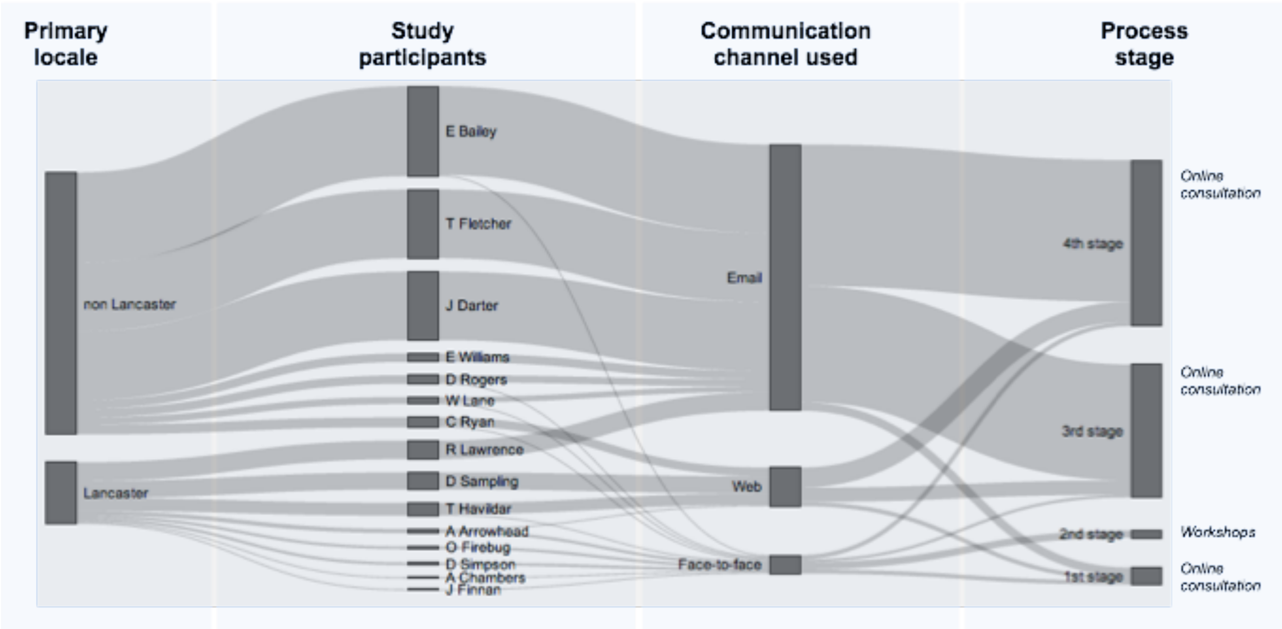


Figure 32: Overview of study participant's interactions as based on archival data

The network representation (Figure 33) reconstructs any participant-comment linkages amongst the participants included in this study. Blue nodes represent participants. Radially around them, in grey, are the comments that they left on various topic. By showing the number of comment nodes for each individual, the figure shows the participants' different activity levels. Participants E. Bailey and T. Fletcher contributed most comments, while participants like A. Arrowhead contributed the fewest. Regardless of their various topic interests and locations (being in Lancaster as a resident or contributing remotely as an off-site actor), all study participants could be connected through their comments left at various points in the underlying planning documents.

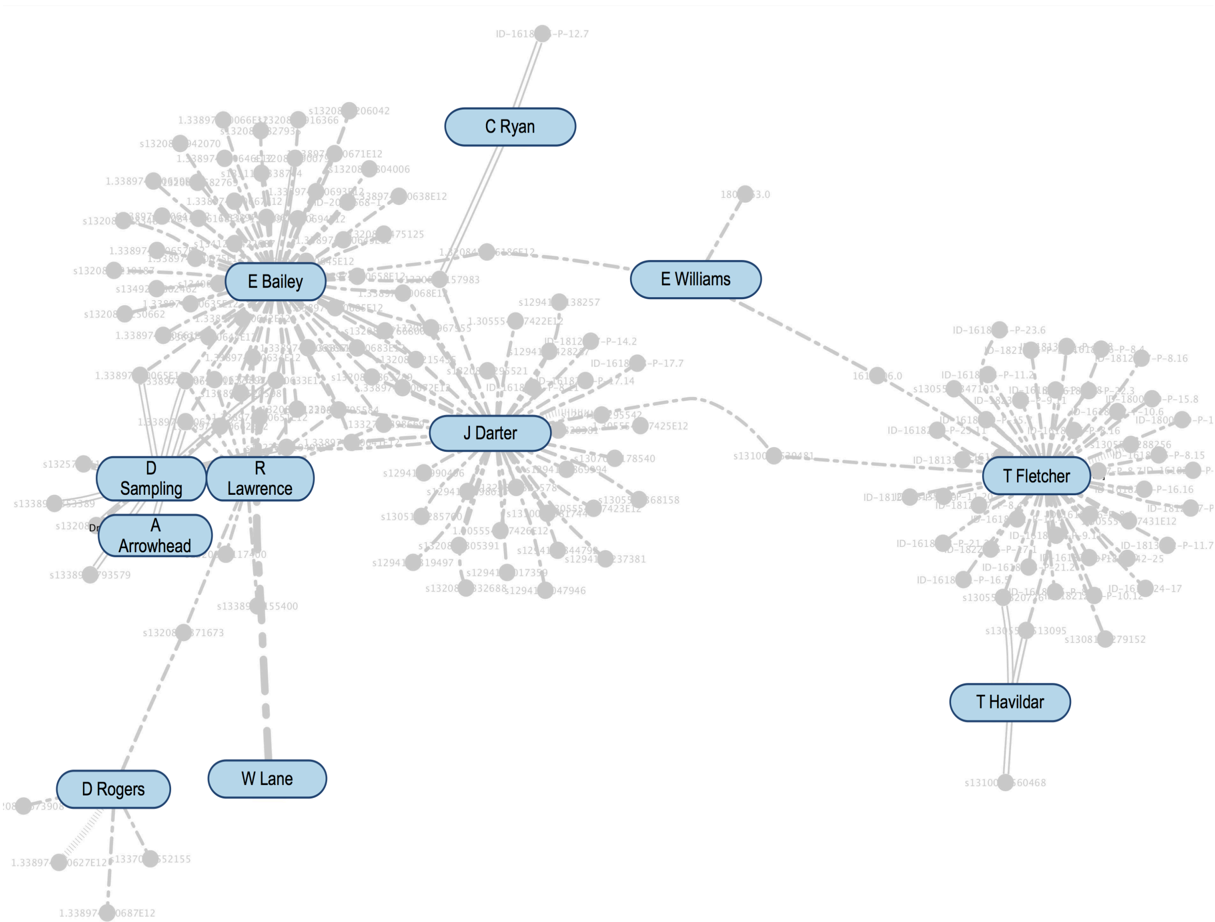


Figure 33: Actor-comments network representation

APPENDIX IV

ANALYTICAL NOTE ON ANALYSING THE CONTENT OF COMMENTS

For identifying topics communicated within comments on different sites, we used an advanced online-accessible natural language processing (NLP) service[162] to analyse the text corpus for each comment. To do so, a php script was developed that posted the text corpus of each comment to the NLP's Application Programming Interface (API) and stored the resulting responses in a database table for further processing (see Figure 34). Keywords were extracted for each of the 1160 comments. Each comment could return a maximum of 20 keywords. In total, the service returned 15,450 keywords that we then used to generate tag-clouds by participant group. The weighting of keywords in the tag clouds was determined by totalling the relevance scores for keywords returned by the NLP for each contributor group[163].

[162] AlchemyAPI (http://www.alchemyapi.com/)

[163] For example "brown field" may appear 4 times within a group with ratings 0.1, 0.5, 0.9, and 1. The resulting value would be 2.5 (instead of the usual rating which would have been four).

```php
<?php
    require_once 'alchemyapi.php';
    $alchemyapi = new AlchemyAPI();

    //connect to DB & check of connection
    $con=mysqli_connect("127.0.0.1:8889","root","root","PlaceChangers") or
die(mysql_error());
    if (mysqli_connect_errno()) { ... }
    $con->autocommit(TRUE);

    //This selects all records from the comments table and stores them as array
    $result = mysqli_query($con,"SELECT * FROM Comments");
    print "Rows: ".mysqli_num_rows($result)."\n";
    //Sentiment, concepts and keywords are identified for each row
    $x = 0;

    while($row = mysqli_fetch_array($result)) {
        //print "Run: ".++$x."\n";
        $rep_ID=$row['Rep_ID'];

        /* ... */

        //keywords
        $response2 =
$alchemyapi->keywords('text',$row['Comment'],array('maxRetrieve'=>'20'));

        if ($response2['status'] == 'OK') {
        foreach ($response2['keywords'] as $keyword) {
            $text=$keyword['text'];
            $relevance=$keyword['relevance'];
            $query2=mysqli_query($con,"INSERT INTO Keywords (Rep_ID, Keyword, Relevance)
VALUES ('$rep_ID','$text','$relevance')");
            }
        } else {
            echo 'Error in the keyword extraction call: ', $response2['statusInfo'];
            print $rep_ID;
            }

        /* ... */
    }
?>
```

Figure 34: Screenshot of the php script that was used to query the AlchemyAPI natural language processing (NLP) service. The script passes the text corpus of official comments to the NLP service and stores the returned keywords.

To understand the key group-level concerns, we carefully generated word clouds. For the clouds, we used the keywords that we extrapolated from the text corpus of individual comments. The method for drawing the word clouds weighted the relevance of individual keywords by forming the sum product of the relevance of each repeated keyword per citizen group. Additionally, the algorithm differentiated between tags that originated Lancaster (red) and non-Lancaster (blue) contributors. In this way, the content of each group competes with one another as is often the case within formal town hall meetings.

For local residents (see Figure 35), keywords ‘greenfield’ and ‘brownfield’ site clearly indicate the prominent opinion that built-on land should be redeveloped before empty greenfield areas are built upon. Some less frequently mentioned words relate to the traffic congestion that is feared by some residents in Carnforth and Silverdale as well as along the A6 if major greenfield sites are developed (A6, traffic, peak times). The issue of new housing (new homes, housing, new houses, new housing, houses, housing development) features prominently.

Figure 35: Keywords for participants without formal organisational affiliation

As seen in Figure 36, the tag in cloud for developer-affiliated representatives shows the frequency at which specialist terms are used. Here specialist terminology features prominently (land allocations DPD, core strategy, paragraph, policy). The names of some key sites are mentioned (site, south Lancaster, Whinney Carr site).

Figure 36: Keywords for participants focused on development

Political representatives came from the County Council (responsible for education and highways) and national government departments and agencies (such as Natural England). The tag cloud (see Figure 37) heavily features green issues amongst local government representatives. Tags are indicative of the concern for potential impact (biodiversity, contamination, net loss) and uses special terms (e.g. Green belt, Morecambe Bay SAC, wildlife corridor, European designated sites).

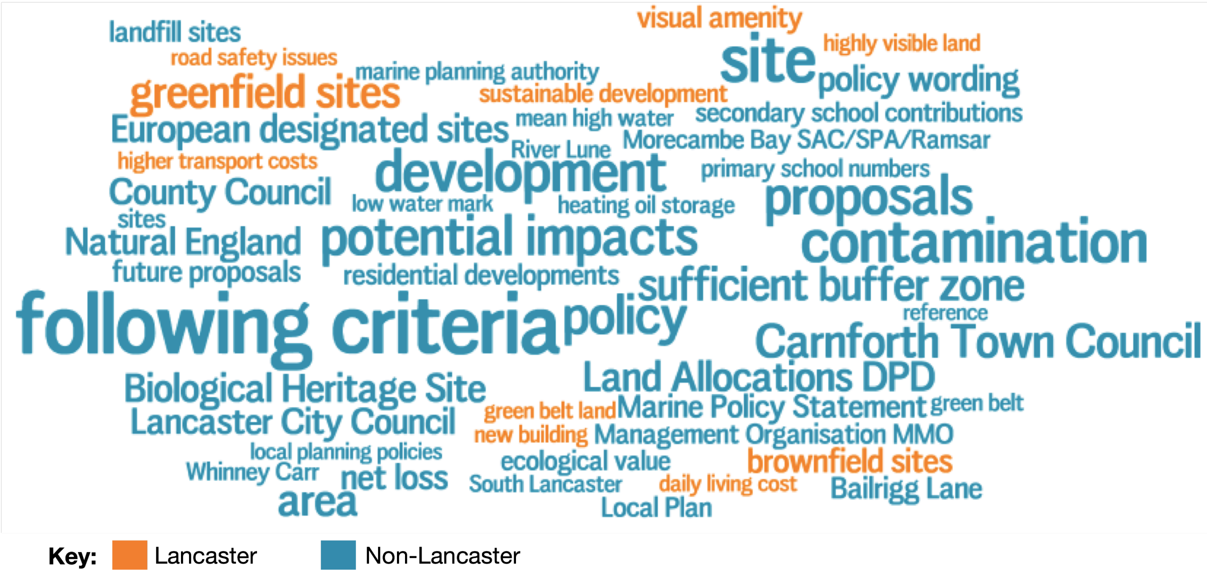


Figure 37: Keywords for participants from political organisations or organisations affiliated with government

Special interest groups include all other mostly non-profit organisations, which are not politically affiliated (see Figure 38). Mostly these are either local interest groups, or national charities (for example English Heritage, Sport England, and the Canal and Rivers trust). Recreation was an important topic (open space, outdoor sport, PPG17 study, pitch strategy, playing pitches) but also green issues (ANOB management plan, Nationally designated landscape, scenic beauty).

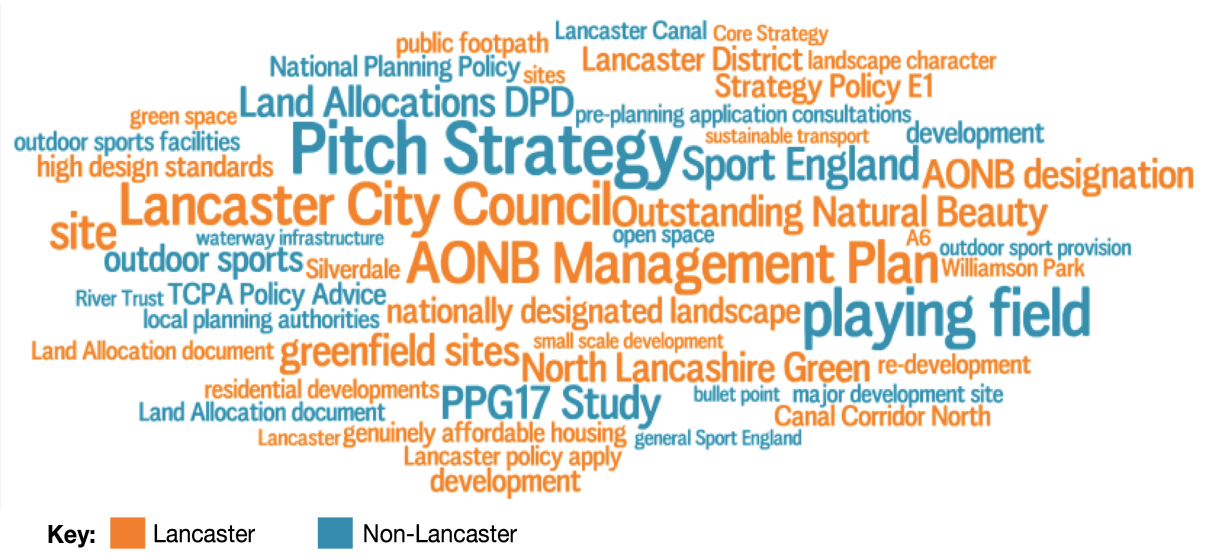


Figure 38: Keywords for participants from special interest groups

The tag cloud for representation from organisations not focused on development (see Figure 39) included infrastructure providers, who have interests in the area (such as the power station operator and the port). It also includes some other companies (such as a mining operator and a local ICT company). For this matter, issues of electricity delivery feature in this post (national grid, live electricity conductors, electricity transmission).

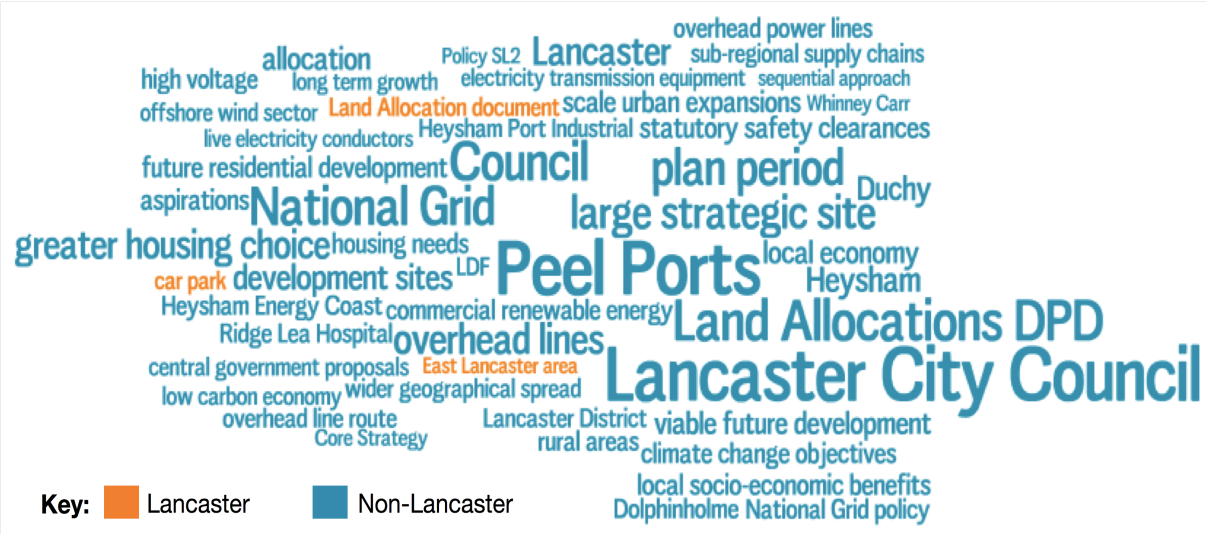


Figure 39: Keywords for participants from business organisations not focused on development

The tag clouds have given an indication of the relative vocality of individual groups (local and non-local). As expected, tags of local contributors feature prominently in the tag clouds for participants without organisational affiliation as well as those with special interests. Next we concluded the analysis by considering the overall impact that individual groups had on the planners' choices.

APPENDIX V

THE CASE STUDY DATABASE — TOWARDS A PLANNING API

This appendix briefly revisits the case study database that was the basis for the primary case study presented in CHAPTER 5 and CHAPTER 6. Built within a user-friendly relational database software[164], it became an invaluable resource throughout my thesis work. Besides storing and synthesising archival data received from the project partner, it served as project management tool. Beyond the synthesis of archival data, it contained contact summary sheets for each research participant. Furthermore, by linking participants with their respective participant identifier in the official archival data, the database served as a data accounting log (Miles et al. 2014).

Through the data synthesis, the research database evolved over the course of the study and represents another product of my thesis work. For example, the database can now be used as a source for interactive online applications (such as visualisations and analysis). For this, its underlying data structure provides a guideline for a possible application programming interface (API) for planning (planning API). These functionalities were important for the analysis in CHAPTER 5 .

V.i Secondary data sources

Several data sources made up the overall content of this database. I would like to mention the most important sources which were the consultation data and event attendance records, a full site repository for the planning area, as well as other auxiliary data (as an example I provide the index of multiple deprivation, IMD).

Participation in consultation and workshops: First, the base data came from eight data tables from two consecutive online consultations. The tables listed participants, comments made on a policy document, replies of officers, etc. Furthermore, event attendance records for five workshops and a smaller online consultation were added based on documentation from PDF documents. Based on the disparate data input, three data tables were constructed that included a unified participant list, a register of all comments and a table with individual consultation events.

Site repository: Second, the council supplied the formal site's repository for two online consultations. These records included information on the boundary, size, and

[164] FileMaker Pro 12 was used within this study. This product is build and marketed by FileMaker Inc, a subsidiary of Apple Inc.

location of individual sites. Similar to the unified participant list, a unified site repository table was constructed based on two individual tables to increase the versatility of references to the same sites in each of the two main consultations.

Additional data (index of multiple deprivation): In addition to the base data, other statistics from national databases were imported. For example, the Index of Multiple Deprivations (IMD) was added to the FileMaker database. The IMD is an established multi-dimensional measure of deprivation of a census area (super output area = SOA) produced by the UK's national government. The measure can be helpful in the consideration of deprivation as a factor that influenced contribution levels to a local plan. Embedding such information provided additional options to the possible data analysis.

V.ii Database structure — A template for a planning API?

Towards the end of the thesis write-up, the data in the database was sliced up into:

- Contributions: 2500 instances of contributing (in the majority of all cases a textual contribution but occasionally also a face-to-face interaction in which case there are no details of specific contributions or outcomes)
- People: 600 individuals registered in the database to have had either of the above contributions (text or face-to-face)
- Events: 12 events meaning instances of interaction
- Themes: 470 themes, known as "consultation points", which reference contributions in online consultations to specific sections in the underlying plan document draft. These themes can represent a specific topic that often has a geographical attribute.
- Places: 185 sites listed in the site portfolio. These only represent a small submission of the overall site portfolio of the council, which at times considered many thousands of land pieces, but it was these 185 sites that were proposed in the 2011 land allocations document.

The data provides a basis for a planning API that could be queried by various citizen groups for whatever they may be interested in. If they are interested in a particular point in time, then the event view may be useful as it contains statistics aggregated to a chronological sequence of planning events. On the other hand, if a citizen was interested in comments relating to properties in an area, a corresponding geographical view (as suggested by the 'places' data table) would be far more useful.

For new forms of participation to occur, transparency of the underlying information space is of importance to aid participants in finding the information relevant to them. The development of a relational database for the thesis has derived such a tool that worked well for retrieving different statistical data related to a number of slices. What statistics or data displays may be developed is an open question and interesting to explore in future work.

V.iii Benefits of database development

The development of the database was useful for generating a technical support tool as well as a boundary object for supporting new insights and learning about the process. It was possible to answer questions such as: Who are the contributors? How many are there? How much did they contribute (both when and number of comments)? Where are they based and what do they comment on? All of this can be analysed across time as well as geographical space.

From the point of view of the analyst, this resource provides the great ability to "slice" the archival data in different ways. An academic could write a separate scholarly paper on each of these slices. At the same time, as was suggested in the prior section, the ability to slice the dataset would be of use to citizens who indicated that interactive data representations for planning would support their participation. Planning documents have been criticised for being too static.

In terms of data displays, such a database helped to easily generate the data tables for novel data representations. As such they could support flow diagrams (as used in the information systems analysis in this thesis), network analysis, and geospatial analysis and visualisations. Having such ability is hugely powerful as in doing so new insights can be generated by understanding the datasets in their entirety on aggregate levels for instance.

APPENDIX VI

ANALYTICAL NOTES ON DEVELOPING AN INTERACTIVE IAD INTERVIEW FORM

This appendix briefly describes the development of the interactive interview form for CHAPTER 7. This interview form implemented the case study framework within a relational database tool[165], so that it can be applied to a comparative information system analysis of different urban computing applications.

VI.i Essentials

The visual interface (see Figure 40 for a screenshot) features the essentials of the IAD framework and provides a framework for research participants to re-articulate their experiences working on their project based on the concepts within the framework. For each project, it establishes basic information (project details and resource characteristics) including the major participants in the participant ecology, the various technologies used, policies (legal frameworks & 3rd party guidelines) encountered, and the ecology of the artefacts (both digital and physical) that were in use.

Participants are then encouraged to restate their experiences in a number of action situations. They can give action situations a title, describe them, and detail a time frame and an outcome. Participants are then encouraged to indicate the information artefacts, participants and ICT facilities that were involved in this action situation. In the final step, participants would attempt to express which institutional hierarchy applied to action situations. For action situations that develop a context for subsequent action situations but involve a different set of actors a “collective choice” action situation can be assumed. In this thesis, collective choices made by planners affected the ICTs available to all citizens. On the other hand, “operational level” actions were those that had little effect on the infrastructure but rather determined the structure of individual participation events (see CHAPTER 6).

[165] FileMaker Pro 12 was used for the implementation

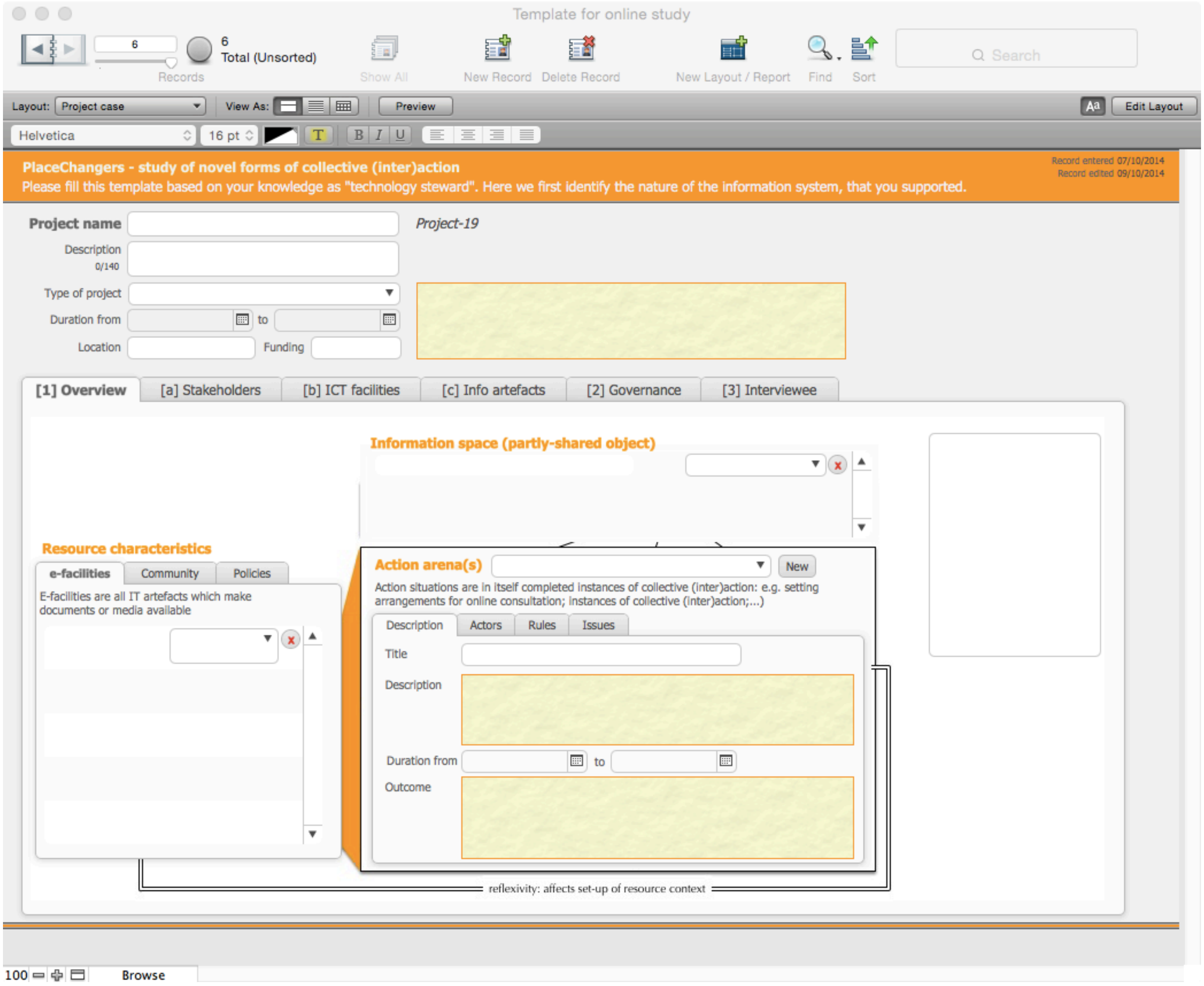


Figure 40: Screenshot of the interactive analysis framework

VI.ii Testing and development

The development of this tool occurred between early April and May 2014. Before using the framework in a research context, it was tested twice in two trial interviews in April 2014.The trial interview helped to prepare a final version of the interview form. Both trial interviews were administered face-to-face.

VI.ii.i First trial

The first trial interview involved a project known as 'Lucid Lancaster', which supported the engagement of a large number of Lancaster residents and visitors in the capturing of geo-tagged photos with a certain methodology to evaluate their feelings towards places in Lancaster (UK).

It was difficult for the participant to understand distinctions between 'collective-choice' or 'operational choice' level to these situations. Hence I concluded that this tool cannot be self-administered by research participants but that they would require active support.

Going through these seven rule types that Ostrom (2005) suggested made participants think about the governance set-up that applied and therefore allowed reflection on how external participants got involved in the design of the information package for this project. Overall, the participants thought that the tool and the tool-guided interview were useful and suggested there would be great value in developing interactive data visualisations using the data collected via the tool.

VI.ii.ii Second trial

The second trial involved a research participant who led the development of an online-based video crowdsourcing site. At the time of the interview, the platform had attracted GBP 20,000 investment from academic grants. The development of the platform was still incomplete.

In this case, the application of my analysis tool was not straightforward. Since the development was incomplete, the test interviewee had difficulties in classing the project as “temporary” or “permanent”. The interviewee pointed out that the platform development is not finished and it is hoped that the next design iteration will lead to the completion of the development phase. Due to the discussion, a life cycle concept was introduced into the final interview form that so that the ‘stage’ of development for the information system can be documented.

For similar reasons, the interview participant had trouble in identifying clear action arenas for which we could analyse the participant’s and emergent habitual practices (rules). For the interviewee it was difficult to differentiate past action situations from on-going issues, as he was still working on similar user interface changes. However, after a while we were able to find an action arena that was suitable for the analysis. This showed the boundaries of the form and trained the analyst in navigating choices with regard to suitable action arenas.

VI.iii Notes on applying the form in information systems analysis

The interviews with expert informants were then held on the 8th and 16th of July, 2014 respectively. Just as with the trial interviews, the interviews with two expert informants further helped us to learn about the application of the interview framework. Here, I have captured essential outcomes from these ‘user trials’ that were useful for adapting the interactive IAD interview form. Judging by the positive response, the framework seems to be useful as systems analysis methodology for which institutional analysis was favoured previously by others (Healey 1999).

VI.iii.i Defining action areas

Just as in the earlier trials, identifying and delineating meaningful action arenas proved to be a challenge. The concept of circles of participation (Crowston 2011) was helpful as it enabled identification of a set of key outcomes that were required to sustain the operation or development of the information system. For example, Figure 41 shows how the involvement of the same team across two proposed action arenas helped in merging those two action arenas into one. After action arenas were agreed, core organisers that were central actors in each action arena could be identified and it was then possible to discuss the rule structure (habitual practices) for this interaction arena.

interviewer: *Yea, it is not really about the research output. It is more about the actual system so if [the platform] were to go live as a sustainable object then these are the kinds of information artefacts (in use).*

respondent: *So for [name of second iteration of platform] we went further, published it on the Android market, and made flyers and so on, but I am not sure how you want to separate that?*

interviewer: *They (were) different audiences (weren't) they?*

respondent: *They are different audiences that is true. We could stay with [name of first iteration of platform].*

interviewer: *(Could we) combine prototype design and implementation of the prototype potentially? So we do that maybe as one. Then I would say we delete that one [implementation]. So essentially what we are ending up with are these two phases of designing and then trying to put it to use [use of prototype].*

respondent: *Yes, I mean that would make sense because for us prototyping and implementation happened within the same team.*

Figure 41: Collaborative process of reframing and agreeing on two action arenas of "Prototype design" and "Use of [platform name]".

Finding starting and end points of events associated with action arenas: It was hard to define the respective action arenas' duration, since the beginning and end of activities were not clearly definable. While final statements depend on the interviewee and their perception of the action arena, it proved helpful that the analyst already had some predefined suggestions of possible action arenas based on published information on the project. Before temporal bounds are specified in the form, the analyst should note the rationale of the interviewee for why this date range was chosen.

Defining constituents within the action arena: Particularly during platform development, it was difficult to define the role of the emerging platform. For example, if an arena focused on the designing of a prototype, it could be argued that the prototype is not yet an ICT facility. Participants needed clarification which artefact could now be classified as an ICT facility. One of the study participants brought attention to this point by asking: "So are these the ICT facilities that enabled the prototype design or that came out of it?" The correct answer is likely that other ICTs were required to produce the initial prototype which led to the confusion (see Figure 42).

interviewer: *(What were the) ICT facilities involved at this stage [platform development]… the outreach platform potentially?*

respondent: *Why not all of them? I mean they became part of the actual prototype. Maybe not the QR tags which came later […] Isn't it right? I mean the [name of initial prototype] is basically the last functional prototype because there is no product we delivered in the end.*

interviewer: *Is it maybe so that [the platform] (was) around only to the end and […] mostly (came) live at the next stage? I am just wondering if it is fair to say that the ICT facilities (that) actually allowed the prototype designing to happen (were) for example the Google service [collaboration platform].*

respondent: *So are these the ICT facilities that enabled the prototype design or (those) that came out of it?*

interviewer: *Yes, in this case it would be about the ICT facilities that you used during the systems development. I suppose emergent from that was then the actual infrastructure [ICT facility accessible by end users].*

Figure 42: Process of clarifying the ambivalent role of ICTs within the design of the later ICT facility.

VI.iii.ii Appreciating multiple roles

A related challenge then is the categorisation of individuals and group actors in the participant ecology tab ("[a] stakeholders"), an issue that will likely apply as a limitation to the other tabs on ICT facilities and information artefacts. These tools can play different primary roles depending on the action arena in which they are involved. For example, on the constitutional level, a technology facilitator might be the main person heading up the main ICT facility, but once this person gets involved in a particular operational action situation, she or he may then perform as knowledge intermediator. These transient or multi-role relationships should be noted down in a memo in relation to particular constituents (ICT facilities, information artefacts, and people).

VI.iii.iii Analysing rules

As the form was used, the elicitation of rules began with the 'position rules' (see Figure 43), and hence by enlisting the human participants and their roles within an action arena. In terms of the interview, this began by referring to the role that the study participant played in this action arena. All further rule types would be probed by considering them according to the human actors involved. The form could be more explicit about how that worked as the respective form only provides a free form text.

interviewer: *How about the neighbourhood association?*

respondent: *Maybe you can put them as co-organisers. Actually I would say there is one person who is quite active and he was maybe the one who was the most aware of (the initiative) and helped with advertising it.*

interviewer: *How about the other residents in the area? How many were there?*

respondent: *It depends. Those who contributed to the [the platform] were active contributors but how many of them? Let me see... it is hard to say because you could use the urban mediator as an anonymous person and most people used it so so we cannot say for sure if the other people were different or the same people who logged in at different times. I would say very roughly maybe you could put about 60 people as active contributors.*

interviewer: *And otherwise in the district or neighbourhood, how many are there?*

respondent: *If you take the area at its maximum limits it would be around 6000 people.*

Figure 43: Enumeration of citizen actors within the action arena. These provided the bases for probing all other rules.

VI.iii.iv Technical and institutional challenges

It was sometimes impractical to make clear-cut distinctions between technical and institutional challenges for an action arena. To some extent, technical and institutional challenges overlapped and were difficult to separate (a point that Actor Network Theory frequently draws out). Secondly, the analysts should consider what these challenges relate to. For example, were the challenges more related to issues within the action arena or does it refer to challenges for individuals within an action arena to *affect* another action arena (such as influencing a third person or group). We received a multi-layered response (see Figure 44). Depending on the goals of the analysis, the analyst can anticipate these ambiguities and ask relevant clarification questions.

respondent:	*I think there are two sides to (this): There is the citizen's side and there is the planner's side and as I said we had a citizen perspective, right; but on the planner's side there was a lot of concern what would they do with all these comments and all these photos and how would that help them?*

Figure 44: Probing for technical and institutional challenges provided for a multi-layered response

VI.iv Final notes on using an interactive form

The interactive delivery — conducted via Skype - proved to be a versatile method for data collection. It resulted in good data quality as the steps for conceptualisation of the case were mutually agreed in the conversation between the analyst and the participant.

Participants managed to 'surprise' the interviewer through their own inductive reasoning. It showed that the framework provided a suitable terminology for the expert participant to show their ability to take on the framing from the interactive interview form (see Figure 45). On the other hand, it indicated the importance of careful choice of the possible research participants. Research participants in this case study were well aware of the challenges of developing a platform that would enable mass-participation, which made it easier for them to use the concepts that the framework provided.

respondent:	*The planners are within contributors. So the contributors would be different citizen groups and planners.*

Figure 45: Self-reasoning by study participant shows an appreciation of the conceptual categories.

The form and the process of filling it in were well received by the two specialists (see Figure 46). I therefore think that the interactive interview performed well as a data gathering tool and productive analytical framework.

respondent:	*Yea, I liked the way you document the interview with this structure that you have already prepared. That is kind of nice.*

Figure 46: Feedback by study participant

However, interview trials as well as the actual participant interviews pointed to the importance of a trained analyst. The interview template does not undo the need for a qualified interviewer who has some experience in using the framework. Although, on the other hand, the framework is only brought to life within a particular case study. The objective in each case study may vary and hence the analyst would likely adapt the framework to the new requirements in each case.

VITA

Sebastian Weise obtained a Bachelor in Business Administration (BBA) from Lancaster University Management School. While his specialisation was in business development and marketing, he took great interest in practices of organising which caused his interest in the role of digital media technologies in sustaining and facilitating collective action. In his most recent work, he focused on citizen participation in spatial planning. Through this work he developed knowledge and skills to advise organisations and groups on the use of locative media technologies in support of cooperative and collaborative practices online. Following his PhD, he established a start-up focused on engagement in planning using locative media. In November 2015, he joined Newcastle University's School for Architecture, Planning, and Landscape as a lecturer in digital civics.