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HCI, policy and the Smart City

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While the idea of the 'Smart City' has attracted increasing attention from academia, industry, and government this interest has largely had a technical and technological focus. This paper identifies some of the important political and policy challenges facing the idea, the discourse, of a 'smart city' as a means to optimise HCI input into the 'smart city' debate. It then addresses that gap by detailing a research project that explored how experts in smart city research and development in the UK context responded to this policy challenge. Experts were asked questions regarding their prior experience with the "smart city", their understandings of what it means for a city to be smart, and what policy potentials they've recognised in the smart city. The paper analyses and offers a synthesis of the responses collected throughout the research with the current policies concerning various smart city proximity, thereby providing a critical assessment of the values underlying the smart city. The paper aims to explore and present some of the policy possibilities for UK smart cities that are potentially useful for politicians, policy makers, planners, academics, and technology companies. I believe that these perspectives for policy development can be used to inform responsible development, spatially and socially inclusive technologies, and ultimately more resilient and liveable cities.

HCI, policy development, the smart city, ethnography

1. INTRODUCTION

This paper continues a growing emphasis on the 'political' dimensions of HCI (DiSalvo et al. 2010; Dourish 2010) by considering the political and policy related aspects of the notion of the 'Smart City'. The idea of the 'Smart City', as a means of city making, has been attracting increasing attention from academia, industry, and government. A wide range of information and communication technologies (ICT) have, as a consequence of the notion of the 'Smart City', become enmeshed in the urban landscape and city life. The 'Smart city' therefore, has emerged as the newest incarnation of a future city ideal. Cities, in close collaboration with technology companies, architectural firms and university tech and engineering departments are now developing smart city policies to optimise urban processes by deploying various ICTs. Prevailing discourses around smart cities have until recently been largely positive and self congratulatory (Hollands 2008), with primary focus placed upon technological solutions to the complex issues cities face (Greenfield 2013; Hollands 2008; Townsend 2014). Policy discourse on the other hand has been left behind in this smart city visioning. As Nam and Pardo (2011) pointed out that only little research discusses innovation in policy while the literature of technology innovation is abundant. While commentators tend to spotlight the technological facet of a smart city, its organisation and policy issues have not gained much attention. Policies, as the motivating power behind technology adoption or implementation should be brought higher up on the agenda for the reasons that the support of government and policy is fundamental to the design and implementation of smart city initiatives (Nam & Pardo 2011).

In the article *Public Policy and HCI: Making an Impact in the Future* Jonathan Lazar (Lazar 2015) called upon more HCI researchers assisting public policy making in order to optimise their research impact. This argument is potentially dangerous in smart city context for 1.) could we make policy on a notion still under exploration and research? 2.) what is the potential societal consequences of making such a policy? This paper explores what influence policy could leverage in smart city agenda and why we should be mindful of that influence.

The paper is structured as follows: I begin by presenting the academic context and policy status quo for this paper, followed by an overview of the methods I used during the project, highlighting some of the challenges I encountered while applying these methods. This is followed by a discussion of our research results, as well as the implications of the results, and the limitations of the project. The paper is concluded by outlining questions that were left unanswered during the project.

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2. CONTEXT

Unfortunately, as with so many popular terms, the term 'smart city' is poorly defined, which results in some confusion and uncertainty for many researchers, policy makers and cities. There is a general lack of consensus on exactly what 'smart' means and how cities should approach this agenda. Becoming 'smart' means different things to different audiences, leaving cities with no clear sense of which issues they should focus on and which technologies they should implement. Given the lack of definition, there's no one route to becoming smart, and different cities have adopted different approaches that reflect their particular circumstances. Angelidou (2014) attempts to dissolve this confusion by offering an analysis four strategies 1.) national versus local strategies; 2.) urban development stages, new versus existing cities; 3.) hard versus soft infrastructure oriented strategies; and 4.) reference area, economic sectorbased v.s. geographically based. However, far from dissolving the confusion, these various strategies have simply echoed the problem that the 'smart city' is a concept that often gets 'lost in translation'.

2.1 what could policy do?

A policy is a deliberate system of principles to guide decisions and achieve rational outcomes. A policy is a statement of intent, and is implemented as a procedure or protocol. According to Sabatier (2012) the process of public policymaking includes the manner in which problems get conceptualised and brought to government for solution; governmental institutions form alternatives and select policy solutions; and those solutions get implemented, evaluated and revised.

In the smart city agenda, policy could serve as a powerful means for us to unpack the smart city notion, understand the current issues and provide feasible solutions. Looking specifically at the UK, as stated in 'Smart Cities', a background paper from gov.uk, there are six key areas for policy making to help UK firms to exploit their capabilities in smart city development. They are:

- encouraging and empowering city authorities to develop the vision and leadership to provide solutions to their own problems;
- promoting open data and the capacity of organisations to improve access to open data, to share and to use it, including the development of open standards;
- programmes to develop underpinning technologies and to demonstrate their efficacy;
- departmental programmes to encourage the adoption of new approaches and technologies, to transform both the service systems and consumer behaviour;
- participating actively in EU programmes
- helping UK firms to exploit their capabilities in global markets.

However, there is a clear disconnect between 'vision' and 'policy' and in consequence the dissonance between smart city practice and policy remain unaddressed. For example, searching the key word 'smart city' in gov.uk policy page, no results were found. This is not to dismiss other endeavours by the government in smart city policy related area but to highlight the vagueness the notion still embodies. Government policy Broadband Investment especially the Super-Connected Cities programme provided options for wireless connectivity which key to smart city feasibility. Similarly, The Open Standards principles are the government's policy on open standards to make government IT more open, cheaper and better connected. Government policy business and the environment is in place to support innovations that make products and services more environmentally friendly. England's cities are promised new powers and freedoms through City Deals. The government strategy for low impact building shows how it will provide up to £60 million in funding for innovation in low impact building over the next 5 years. Low carbon technologies policy is to increase the amount of energy the UK gets from low-carbon technologies such as renewables and nuclear, and reduce emissions through carbon capture and storage (CCS). Comparably household energy policy is to help households keep their energy bills low, support those most in need and take action to help secure energy supplies in the long term. All these selected policies from the government are within the realm the key areas for UK smart city policy making. They either empower the local authority, encourage technology development, adoption and efficiency, or to support business innovation and growth. And the list goes on to policies that are tangentially related to smart city agenda such as cyber security which is to make the UK one of the most secure places in the world to do business online and help to shape an open, vibrant and stable cyberspace that supports open societies, etc. Government policy on research and development intends to utilise UK's talent in research, development and innovation to make the UK the best place in the world to run an innovative business or service. Planning reform policy is there to ensure people's right to influence decisions that affect them.

Meanwhile Parliament Office of Science and Technology (POST), is Parliament's in-house source of independent, balanced and accessible analysis of public policy, issues policy briefings related to science and technology. There's no POST notes reporting about smart city but there are four reports from 2014 featuring big data which is another key area for policy

making in smart city. It is also the core of a lot of smart city developments such as 'OPEN Glasgow', 'Bristol is Open' and 'MK:Smart'. There is also one note from 2014 reporting smart meter and energy usage. In addition, the POST note Towards 2020 and beyond from this year looks into the relationship between the UK policy and people, technological change, climate change, and sustainability etc. The policy drives discussed in this report overlap with the issues that motivates smart city development. Although the 'smart city' has not been directly addressed by any direct policy or POST yet, issues and topics that are key components of smart city have been researched, published and some regulated.

Another concern is that these disconnected policies concerning smart city might deliver a disjointed collective of smart parts within a city rather than a holistic system that serves as a city. That there is a possible clash between smart city policy and other existing and developing policies, for example concerning individual data privacy and security. The smart city vision has been criticised as functional but not liveable for citizens (Hollands 2008; Greenfield 2013; Thomas et al. 2015; Thomas et al. 2016) and arguably without bringing together the segmented smart components this critique might be the future we are heading towards. The emphasis on big data and data mining from government's policy briefing spotlights another concern in smart city agenda. Smart city development often receives the criticism regarding concerns over data privacy, security and value. Due to these issues the data needed for initiatives such as open data platforms and the integration of health services is not easily made accessible. For example, the launch of care.data, a database which integrates data gathered from GPs with hospital medical files was postponed due to concerns over data privacy and possible breaches (Triggle 2014). Despite these potential violations of privacy and security, the question needs to be answered first is whether smart city is simply a data gathering exercise?

Academic endeavours on smart city policy development, as opposed to technology development in the UK are also comparatively underdeveloped. Angelidou (2014) has offered various spatial strategies for smart city policy to adopt but there's no literature touched the policy concerning HCI in smart city development yet. Nam and Pardo (2011) unpacked the smart city discourse and suggested the three ways for policy innovation. Alawadhi at el.'s (2012) research set out to understand the building of a smart city and from their empirical study that discuss the policy context for four different cities (Philadelphia and Seattle in the United States, Quebec City in Canada, and Mexico City in Mexico) and discovered that the smart city policy varies depending on the city, city manager or mayor, and his or her political position. Their findings pointed out that interdepartmental agreements shape the policy context of the initiatives and the executives' policy directions shape policy context. Chourabi et al (2011) regards policy as one the drivers locate in the inner circle of smart city initiatives framework.

3 FIELDWORK METHODS

I designed this project as an ethnographic exploration of expert's experiences with and understandings of "the smart city". The experts who participated in this project are leading figures in senior positions in the field of smart city. I initially intended to complete in-situ observation that described what smart city research or development projects these experts are involved in or in charge of, where these projects take place as well as how they conduct these projects. Two ethnographers designed the fieldwork strategy and one ethnographer carried out this fieldwork over the course of three months from the December 2015 to February 2016. However, when I began the fieldwork, I encountered two primary obstacles. The first obstacle I encountered was with regards to our intent to make in-situ observations about experts' research or development work in the "smart" city. Although a few "smart parks" and "smart" municipal service systems exist in the cities our experts work, I found it difficult to observe these experts specifically interacting with those systems in and features of the city. Secondly, I had difficulties coordinating with our experts to conduct even minimum length of observation. Most participants I approached have a busy schedule or travel between global projects frequently. As a result of these obstacles, I decided to cease our ethnographic observational endeavours and shift our attention instead towards collecting rich data from the few experts who were willing to engage in conversations at their work location.

The fieldwork amounted to five semi-structured interviews, each of which lasted between forty-five minutes one hour in length. (Since this paper was submitted I have collected and transcribed another 17 interviews.) The participants consisted of two senior academics, two senior project managers, and one independent freelance researcher. All five of them come from technology background, they either have received degrees in computer science or have rich experience working for leading technology corporations. In the interviews, participants were asked what their current involvement in smart city research is, how they would define a smart city, whether they have encountered any smart city policy and finally how they see their work could feedback to the smart city policy development. Two researchers analysed the transcription of the interviews, compiled field notes, and cross-examined the data for recurring themes, presented below for further discussion and exploration.

4 RESULTS

The participants' responses are presented below, grouped according to the leading themes that emerged from the answers to the first set of questions (i.e. their role/work in 'smart city' development, their first interaction with the idea of the 'smart city', and their understanding of the term 'smart city'.)

4.1 What is a smart city?

4.1.1 what is a smart city?
When asked what a smart city is, these experts provided some diverse perspectives, unpacking the notion of the smart city in surprisingly different fashions. Some experts provided a definitional understanding, highlighting the features of a smart city such as "near real time monitoring" and "integrated infrastructure". One of the experts decided to unpack the role of technology in relation to urban development, emphasising the overall importance of technology in this process. In his own words, this meant that

> "it is important to understand technology, because of the role of technology, it has always changed cities, (whether) it's flushing toilet mechanism or air conditioning."

In his opinion, we have not paid enough attention to exactly how technology has enabled urban development and modern cities. Cities may seem to be evolving organically but the technology has always been either an enabler or a driver, just as automobiles enabled the proliferated mobility and sprawling city. Another expert on one hand acknowledged the importance of technology, but on the other hand recognised the smart city as a partnership ecosystem. He described the smart city as:

> "it is really about developing new partnerships and a new way of working together."

In so doing, he will be able to improve internal communication within the local council, invigorate interdepartmental collaboration by

> "building an ecosystem that consists of the city itself, the city council, commercial partners, citizen groups university and SMEs."

Meanwhile, the third expert considered that defining smart city is in fact a way of standardising both the system that will used in a smart city and the data emerging along the way. He also recognised the current approach to the smart city as a "cluster approach", i.e. certain areas and parts of the city have been made 'smart' but not the whole city, especially in big cities like London.

4.1.2 The linage of the 'smart city'
When the participants were asked to describe their understandings of the smart city they tended to parallel and compare it with other similar or related concepts. 'Internet of Things' was the one concept that was most referred to in the responses. The 'smart city' was also viewed as a 'neuro-network system' and 'giant artificial intelligence system' by two experts. So, as already mentioned, the term 'smart city' was very loosely defined. Apart from being compared to similar concepts, it was also used as a collective of segments that could come under the banner of 'smart city'. For instance:

> "… to make places smart from a joined up information system. So joining up the Internet of Things feeds, GIS feeds, all into one place, and that links to our Smart Park work."

> "And with [smart city project name], they decided to focus on 3 areas. Transportation, environment and safety and energy efficiency."

> "There are in total 7 work streams, they go from data infrastructure to water, to citizen innovation, to business engagement, education."

4.1.3 When did you first cross paths with the idea of the smart city?
The 'smart city' as a term, might be relatively new. However, the notion of smart city might well have appeared way earlier than the term itself. One expert described his first impression of the smart city as "something old wrapped up in a new descriptive". But when asked about their first encounters with the smart city research or development, all of these experts were able to pinpoint the time when they first set foot into this area or research field. For some of them it occurred long before the smart city was called the 'Smart City'. Using both the time and details of the occurrence the participants gave, I summarised a brief history of these experts' involvement in the smart city. Considering the prestigious positions and influential roles of these experts, this brief history also reflects the smart city evolution within the UK.

The earliest trace of smart city could be dated back to the mid 90s, where using my participants' words:

> "I go back to that because that was the first time I think that I've been looking at these ideas of data and digital and city physical place, virtual spaces, tracking digital activity to understand physical activity, vice versa, kind of everything what we do with smart city more or less, which we were never talking about sensors of course. We just had websites and emails. But we were beginning to do the same things, so I go back to that point."

The brief history of smart city based on the participants' description is very much event based, chronologically ordered and linear.

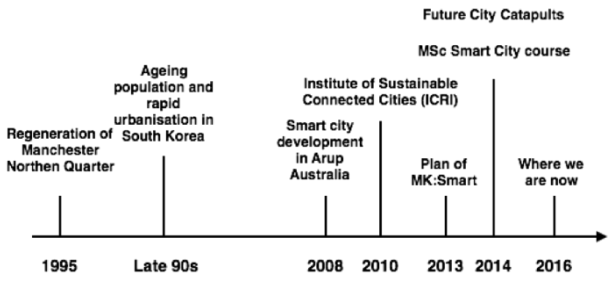

Figure 1: *Brief History of Smart City timeline*

4.1.4 the smart city as a research interest

In addition to clearly identifying when they first encountered the 'smart city', the experts also have detailed their research interest trajectory in regards to the 'smart city'. They mapped out where they come from i.e. their background, how they got into the 'smart city' and where they were now with the notion of the 'smart city'. It became evident in our analysis that their interests in the 'smart city' not only reflected their research and academic background but was also deeply embedded in their career development.

> "So I am coming from the Internet of Things area, I am a computer scientist and I have been working on a number of projects on the Internet of Things, and when I arrived here at [name of a university], there were already a number of people around the city council thinking about the future of the city, thinking about what a smart city might mean for [name of a city]."

> "It's a core part of out lab, so our lab here [name of the lab] has been around for 20 years. So all in one room, there's a hundred of us. And our work is around sensing the movement of crowds, movement [of] traffic, very urban space and internet of things, mapping and GIS."

> "Oh well, I suppose my research on cities goes back to my PhD work. Back in the 90s, late 90s. I was working in [name of a country] looking at rapid urbanisations in [name of a country] and its effect upon family networks, and older people and ageing. So what happened to old people left behind and how did the network operates to take care of the elderly and old people in rapid urbanisation what really what my PhD was about. So, that kind of give me a broad background, it wasn't so much about technology and smart cities, no one was using those terms in the 90s."

The 'smart city' in this sense does not serve as the research interest per say, but rather provides the context where they can continue or extend their existing research interests.

4.2 Smart city policy

4.2.1The absence of smart city policy

As I stated previously, there isn't any obvious 'smart city policy'. But there are policies that come across as policies relevant to the 'smart city' but without being particularly explicit in terms of focussing on the smart city. And the experts' responses in the interviews echoed this observation.

> "I would say indirectly address. Yes, I have seen promulgated government policy that is about the adoption of one or the other platform. More often I see white papers."

> "Well, no in [name of a city]. I mean [name of a city] is trying to get its head around and it' just starting… it's just putting in place a future city's commission. That's looking at this landscape in a much more holistic way. I mean there were sort of light strategy papers, floating around before, that indicated pretty much that it would be nice to do something in this area and Milton Keynes should try to become smart city."

Evidently, cities that are currently undergoing smart city development may have their own municipal level smart city plan or document but the government still lack the coherence in terms of a policy that might "join things together".

4.2.2 Accommodating contesting priorities

When describing the smart city projects the individual experts are leading or working on, they also brought to light some of the challenges they are facing in their research or development work. One common theme was that the smart city development, alongside urban development or even development in general, often needs to accommodate various contesting priorities within a city. Clearly, different cities are often faced with very divergent problems and/or issues.

> "So the city has an expectation of rapid rise in population, so it's tasked with developing new housing, improving the road infrastructure, and making sure all the services are basically suitable to accommodate the growth. Water and transport are the two areas where there are very direct barriers."

> "Yes, I mean clearly the city has targets, it has… it needs to oblige to targets by the UK government, it needs to oblige to targets set by the EU in terms of emission reductions."

These different groupings in the city could then drive the policy into varying and even competing directions in the 'smart city'. Therefore, it poses a complex issue for policy development.

4.2.3 Abstract and conceptual documents

Two of my experts in the interviews critiqued some of the existing smart city documents (white paper, smart city plans, and smart city strategies etc.) as being too abstract and conceptual, suggesting that this could lead to some dissonance between rhetoric and practice. As some of them pointed out:

> "that was very fluffy and very early"

> "it's open to interpretation. But most of them are like that."

4.2.4 From practice to theory

During the interview I discussed my policy, development and knowledge model (see Figure 2) with the experts. Most experts tended to agree with the model in general. Only one expert suggested alongside 'knowledge' or in his words "lessons learned" there should also be space for less tangible knowledge i.e. relationship and stakeholder networks formed throughout the 'smart city' development.

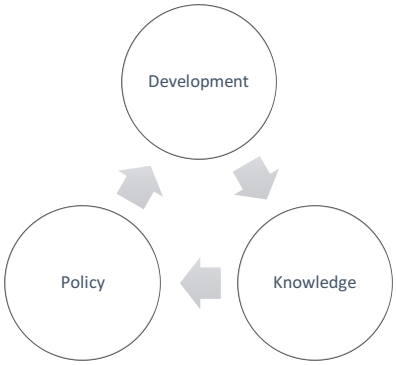

Figure 2: *Policy Development Knowledge model*

When asked how their work would influence the policy development in the 'smart city' or place their work in this model, to my surprise most experts considered their work has limited or even little impact on policy development.

> "In an indirect level. I mean I don't have any direct influence… I think that our work at the [name of the university] and the other universities that are involved, and what the companies have been doing have informed, have demonstrated what might be possible."

4.2.4 Keeping up with the 'smart city'

One of the challenges my experts recognised during their work on the 'smart city' is that development work happens over time, and, in a similar fashion, so does policy generation. Meanwhile, technology, often at the core of smart city development, proliferates and progresses vastly and dramatically in very little time. This mismatch or, more kindly nuanced differences in development speed has the potential to create tensions between policy development and technology adoption. Also as one of our experts highlighted, smart city development often has experimental nature, which makes it even harder to manufacture policy along the way.

> "So you don't put bluetooth on all the pipes, knowing that in 5 years' time blue tooth won't used. And it will be out of date, coz some sort of new tech has come along."

Also, another difficulty here is:

> "We haven't demonstrated that the utility yet. We haven't demonstrated an actual value for the city. Because the things which we built are too small scale and not yet completed. So that, it's very difficult to say that we have any kind of concrete value for the city as a while."

This creates another layer of complexity for evidence-based policy to be developed as there is very little 'evidence' to be found in the current 'smart cities'.

4.2.5 Motivation for policy making

The motivation behind smart city policy making is often complicated. From the interviews with the experts, there are at least three obvious reasons to motivate policy generation in the 'smart city': financial reasons, practical reasons and what might be termed 'ideological' reasons.

In terms of finance: smart city policy has to ensure enough funding to support activities for the development work to follow. But often it is not enough, as one expert put it:

> "It's a small budget compare to the department of housing"

And when they do get the smart city funding, they have also to be very strategic with their budgeting.

> "…because they also know that funding stops at some point… so those guys, they can just snap back to the previous state. Certainly they are getting the funding then gives the chance to win farthing funding, if they executed it well. Coz equally, if you don't execute it well, then you don't get anymore funding for a long time."

Meanwhile, the smart city has to demonstrate its own financial value.

> "But to make place smart you got to put a financial case, and that's to save money. So most places are not really interested in smart in the smart sense, they are interested in saving money on whatever the running of bus network, train network, police and ambulance."

Some experts suggested 'strategy' as an alternative for 'policy' to serve as the guide to smart city development. Throughout all the responses, 'policy', 'strategy' and 'mission statement' are used interchangeably but not necessarily synonymously. However, all the experts expressed an expectation for specific guidance on action in the 'smart city' development.

> "Yeah, there are loads of policies regarding smart cities. So the national municipal level has written some of them at the municipal level, Melbourne smart city strategy, the Manchester smart city strategy last year, constantly engaging with cities like London around these things. So there are a lot of strategies and there are a bunch of policies around particular aspects of urban space or…"

Boiled down to its essence, what we are facing as a policy challenge is actually or fundamentally an organisational structure challenge in the government. As some experts pointed out having smart city 'policy' only is simple enough, there has to be a governmental unit attached to it.

> "the city themselves became much more organised as well, they brought in a smart city coordinator to report directly to the CEO, the chief executive at the council"

> "So NY have a chief technology strategy officer and that changes things… and the technology officer actually linked their city wide information systems."

However, another concern was raised regarding to setting up the smart city unit.

> "Or do you have a separate smart city strategy or even a smart city unit attached to that strategy, whose job is to drive that particular, if you do, you are on the risk of kind of ghettoising it, and all of the other departments, which is where the real delivery happens, transport, education, kind of go, well, digital is over there. Or smart city is over there."

When the individual, dedicated units are in place, we need to be wary about ghettoising their work; they should be well linked with other departments that are involved in the smart city development such as transportation, education and NHS.

And scenarios like this will defeat the purpose of setting up a smart city unit, which is to assist government internal communication and increase interdepartmental collaboration in the 'smart city'.

5 DISCUSSION: POLICY CHALLENGES

These expert interviews indicate the value of adopting a Foucauldian 'archeaology of knowledge' approach (Foucault 2002), (specifically the notion of discourse and discursive formations), for explicating some understandings, and misunderstandings surrounding the idea of the 'Smart City'. The Smart City discursive 'formation' is a coherent discourse possessing common objects, concepts and arguments. The components of a 'discursive formation include; 'authorities of delimitation', 'surfaces of emergence', and 'grids of specification'. So each of the experts I interviewed might be regarded as an 'authority of delimitation', using their comments, papers and publications to define and shape the ongoing debate. 'Surfaces of emergence' point to specific discursive and institutional sites – exhibitions, magazines and books, where arguments about the Smart City have emerged or been re-configured. 'Grids of specification', are the classificatory dimensions of a discursive formation, how it is, for example, related to other important ideas, in this case ideas about urban life, governance and citizen empowerment. Other relevant aspects of the Smart City discursive formation would include the formation of 'enunciative modalities', (who is qualified to speak about a topic, and who is not qualified), as well as the formation of concepts, and argumentative strategies (for example the mixture of anecdote, history and philosophy offered by my experts in their interviews).

In these interviews my participants reveal how a given set of objects and particular concepts such as 'Internet of Things' and 'Connected Cities' have been formed and shaped over time to become components of the 'Smart City' discursive formation. As a particular way of talking about, of constructing, a topic – the Smart City – and its relations with other topics, such as technology, urban life, transport, information etc. – the discourse inevitably limits other ways in which a topic can be constructed – of what effectively it 'makes sense' to say. So whilst my experts do not always directly address policy matters they do effectively frame the debate in which policies get to be considered and approved or rejected. It is in identifying this 'discursive formation' that the merit of this paper and this approach can be found, and why an overwhelming 'social science' concern with the relatively small number of interviewees is somewhat misguided.

The current smart city discourse is still largely focused on the 'hard' technical aspects of smart city development such as ICT development and implementation as well as architecture. However, the discourse of the smart city is also experiencing some shift of focus towards the 'soft' side i.e. social perspectives raging from citizen engagement to participatory design. Yet the political and policy side of the discussion in smart city development is still to be developed; in particular, four aspects of policy making for the 'Smart City' seem important:

(i) Generative models of policy-context-specific policy

A lot of smart city literatures follow a certain pattern. They start with the statement that X amount of us will live in cities and facing X, Y, and Z urban crisis (optional), but we have computers and ICT, moreover we could innovate more digital + physical solutions, hence smart cities. As one expert put it

> "there are a class of urban challenges that appear to be amenable to computational management".

The 'smart city', therefore, sounds like a universal-seeming solution to us all. However, what we need to acknowledge is that smart city agenda should be a context specific one as regardless how generic modern cities and metropolitans are, each single city has its own uniqueness and characteristic. Hence the design for each smart city development should be wary of for which specific city it is for. Smart city policies therefore should highlight and acknowledge

the difference between cities in order to inform different design for distinct smart city context.

(ii) The problem of smart city development

Within smart city development the prevailing discourse has been that technical solutions remedy urban issues. Over generalisation has posed a danger in smart city development because if technology is the solution, then what's the problem? Smart city development is commissioned to solve urban problems, but it often seems to be a solution in search of specific users. Additionally, there is the reluctance of discussing policy and politics in smart city discourse which may result in depoliticising the sometimes highly political causes i.e. simplifying urban issues to a technical problem and promising technological solutions. High tech companies like IBM, Cisco and Intel have offered from large scale technology installations to portable smart citizen toolkits to address various urban problems such as energy usage, transportation, and environmental challenge. However, these approaches fail to discern the importance of political causes and political solutions thus leaving us to many open-ended design and the yet to come smart city vision. Furthermore, whether those smart city toolkits are truly empowering people or simply turning people into part of the infrastructure is another question to be answered. Policy needs to be in place to strike the balance of inclusion.

(iii) Uneven economic relations

> "No design takes place outside of a series of economic conditions that makes it possible." (Irani et al. 2010)

Smart city development regimes have historically been aligned with the interests of politically powerful commercial and capital market actors. Even the term 'smart city' was made a trade mark by IBM. Apart from these techno giants, there are other bigger players in the smart city arena who wish to benefit from better access to the big and open data that smart city ICTs will produce. This fact would lead to two possible problems. Firstly, it is hard for any grassroots smart city initiative to participate in the smart city discourse and their perspective is often ignored [15, 16]. Furthermore, smart cities will not deliver the promise of more smart city or digital economy entrepreneurs as they don't have the same access to the resources to power their innovation. Smart city policy could potentially help to make it a fairer game and easier for grassroots initiatives and individual citizen to take part.

(iv) Knowledge and voice

This last comment points to HCI interests concerning what knowledge contributes to the smart city development and whose 'voice' can be and should be heard. How we might mobilise knowledge to make it portable seems to be an ongoing topic in HCI and well discussed within this community. In smart city context, not only the 'how' to mobilise knowledge should be fully explored but more importantly the 'why'. Smart city development often involves multi-players and stakeholders in the process. As we are designing the city for the many rather than for just a few, we could (and should) use policy to facilitate an understanding of exactly what knowledge and whose knowledge should be included in the 'smart city' debate.

6 REFLECTIONS ON THIS RESEARCH

Even though I believe this research project achieved its initial aims, I think it is important to reflect on the work and acknowledge some of its limitations. As recognised in the methods section, I was unable to carry out the observations as I originally hoped. This in itself seems reflective of the disjunction between the concept and the everyday work. I interviewed a small portion of the experts who work in the field of smart city with a HCI perspective which hardly represent the true diversity of all the disciplines that are involved in the 'smart city' agenda. Moreover, my data gathering took place entirely within the United Kingdom, meaning that many of my participants' responses were based within developed cities with a well-established infrastructure. I believe that smart city based interviews in other countries, such as China, India and the UAE, would likely gather very different responses. That is, the various discursive formations, grids of specification and modes of opposition are likely to be rather different. Thus, while the lack of diversity, and geographic scope of our research could be seen as limitation to this paper it could also be subject to similar empirical investigation.

Similarly, although this research was inspired by a broad set of multidisciplinary readings, its narrow focus on the HCI community could be seen as a limitation. Future work could allocate more space for discussion with other communities that operate in the smart city field. For instance, reviewing works in human geography or human-computer interaction's (HCI) sub-fields of urban computing, urban interaction design (urban IxD) (Brynskov et al. 2014), urban informatics (Bilandzic et al. 2011), and media architecture might offer interesting perspectives to the discourse.

7 CONCLUSION AND FUTURE WORK

The smart cities concept has gained a lot of attention lately and it will most likely continue to do so in the foreseeable future. Cities are publishing smart plans, related conferences are trending and more and more books are being written on the subject. Smart technologies promise solutions for cities by helping them save money reduce carbon emission and manage traffic flows. Since the market for smart technologies is relatively new, it needs viable business

models which are yet to be developed. Cities, the private sector and communities are increasingly recognising that they need to work together in order to make the most of the smart agenda. Hence the government should continue to be the supportive facilitator in this process. It should endeavour to ensure: coordination rather than isolation in smart city development. For example, this will certainly help to avoid the risk of unintended duplication across the different research organisations. Also government's interventions should stay flexible and steer away from focusing on certain sectors/initiatives. Lastly and the most importantly, the government ought to recognise that cities have varying needs and challenges.

The idea of the 'Smart city' so far has been admittedly an effective research endeavour which has fuelled numbers of cross discipline discussions and collaborations; it is also a successful technology agenda. While there may well be an obvious HCI interest in identifying the needs and priorities of the people who live and work in the city, the concept of the smart city might be another 'yesterday's tomorrow' (borrowing Dourish's understanding of ubiquitous computing) i.e. the smart city version of the future may not come. The point therefore is not to bemoan the issue of 'poor definition' but to identify aspects of the current discursive formation that may have policy implications. This paper, therefore, is not to point out the potential pitfalls in smart city policy germinating in order to get there one day. The idea of the 'Smart city' is trying to solve wicked problems in urban context, since, because of complex interdependencies, the effort to solve one aspect of a problem may reveal or create other problems. Like other planning problems, the complexity of the smart city agenda is hindering its progress. It involves a large number of stakeholders (local authorities, citizens, technology companies and academics) each having their own vision of what a smart city should be; and much of the debate gets blurred by trying to understand what 'smart' means rather than focusing on how it can help cities meet their goals. Policy, in this agenda, is not a project of generating or catalysing more smart city development projects to enhance the complexity. It is about organising and bringing together various projects and efforts under the banner of the 'smart city' in order to optimise our collective endeavour.

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