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Thinking about smart cities

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How should we think about 'smart cities'? This issue brings together a set of articles that examine current debates around the goals, ethics, potential and limitations of a concept that has become a metaphor for urban modernity. We also include an unusual addition, a short intervention that surfaces some of the controversial issues related to smart cities, as a conception and as a practical undertaking.

Some of the seeds of today's smart cities can be found in a series of conversations among scholars and practitioners in the 1980s, reflecting on the future of cities. In a book review, Phil Harris, describes a particularly significant intervention by Sheridan Tatsuno of NeoConcepts, a consultant connected to the Institute for Constructive Capitalism at the University of Texas at Austin, a think tank founded in the 1980s by George Kosmetsky, an entrepreneur turned academic. Like others at the conference, Tatsuno was writing at a time when Silicon Valley was the place to emulate and ventures such as the Research Triangle Park in North Carolina served as alternative examples of successful future industrialisation. He, like many others, was propagating the idea that any and every place could be Silicon Valley-like, if they simply followed a prescription:
As Harris (1992) describes:

> Tatsuno calls out "the age of technopolis and the metamorphosis of traditional cities and even high-tech parks. One alternative is the global network city of dispersed, highly interactive economic nodes linked by massive networks of airports, highways, and communications. Another metaphor is the "intelligent city" featuring advanced information/communication technologies, complexes wired for satellite and fiber optics. These network cities are inhabited by "knowledge processors" engaged in rapid information exchanges (Harris, 1992).

As Rob Kitchin lays out in his article in this issue, however, the origins of the smart city are not found solely in the search for technological utopias (Kitchin, 2015). They also originate in the 1980s prescriptions for managed, entrepreneurial cities—whose speed and flexibility in adapting to global markets make them more efficient and competitive (Logan and Molotch, 1987). Kitchin also raises the provocative question of whether another model of 'smartness', the digital or wired city, belongs in the 'smart city' genre. The wired city in fact offered a somewhat different vision, that of inclusiveness in access to digital technologies. These two competing visions of cities transformed by

technologies have not been reconciled despite the recognition that the Internet and particularly, the Internet of things, is a central feature of smart city models.

Although the 'smart city' concept has emerged from long-persisting ideas about urban technological utopias and the perfectly competitive city, it also differs from these urban visions in some important ways. What is new about the contemporary smart city narrative is the emphasis on places transformed by the application of technologies rather than, as in the case of Silicon Valley, places where sectors such as microelectronics and computers drive the urban economy. Smart cities are not just where new technologies might be born. They are the receptacles for technology, the target of its applications. Although saturated as consumer markets, cities present opportunities for firms seeking markets for modern sensing, forecasting and management technologies. Although 1990s city policymakers sought to replicate the job base and innovative milieu of high-tech centres, the contemporary purveyors of smart city technologies see city governments as markets for the products of the last 40 years of technology development. At the same time, ambitious politicians and civil servants are ever on the search for the next 'big idea' to move their city to the top of the rank of attractive places. The race to get on the bandwagon and become a smart city has encouraged city policymakers to endogenise the process of technology-led growth, directing municipal budgets toward investments that bestow smart city status.

The public investments that confer smart city status are impressive. A recent report from a large Australian development company puts a dollar figure on the expected growth of smart cities. According to Ivan Fernandez, Industry Director for Frost & Sullivan, Australia and New Zealand, a consulting firm promoting growth through globalisation,

> The global smart city market will be valued at US$1.565 trillion in 2020. Over 26 Global Cities are expected to be Smart Cities in 2025, with more than 50% of these smart cities from Europe and North America. By 2025, it is expected that around 58% of the world's population or 4.6 billion people will live in urban areas. In developed regions and cities, the urban population in cities could account for up to 81% of total population. This will pose serious challenges for city planners, who will have to re-think how they provide basic city services to residents in a sustainable manner.
>
> Governments of smart cities are transforming from a traditional model of a silo-based organization to a more collaborative, integrated service delivery model. Cities will collaborate with each other to drive smart city innovation by entering into partnerships with each other. Technology and ecosystem convergence, collaboration and partnerships between stakeholders from different industries, such as energy and infrastructure, IT, telecoms and government will also expedite the delivery of integrated services http://www.newswiretoday.com/news/148711/Global-Smart-Cities-Market-to-Reach-US1.56-Trillion-by-2020-Finds-Frost-and-Sullivan/

Smart city advocates include not only large information economy businesses, such as IBM, Intel, Siemens, CISCO and SAP, but also academic and philanthropic organisations. Each has a distinctive sense of what smart cities can accomplish. Academics are attracted to technology applications that offer the ability to 'sense' and track human use of urban infrastructure. They are drawn by the potential that these applications offer to remediate urban problems such as snarled traffic, the lack of parking spaces, and inefficient energy use and waste disposal. Philanthropists see solutions to urban ills with an eye toward greater equity, improved quality of life and citizen empowerment. The large information firms see the vastly expanding market for management applications in an urbanising world as an opportunity to develop

stable revenue streams in the form of continuous contracts. These firms are, however, selling different visions of 'smart' and products to achieve the vision. Competing and sometimes contradictory stakeholder goals contribute to the inevitable conclusion that the smart city is a chaotic concept.

What the smart cities movement has done, albeit perhaps inadvertently, is to reignite interest in cities as engines of growth. This has been perhaps most evident with the model cities created on greenfield sites. A few have gone beyond drawing boards and taken shape on the ground. Each of these cities is unique and hence an unlikely candidate for reproducibility as 'the' smart city model. The distinctiveness characteristic of Song Do in South Korean or Plan IT in Portugal belies one of the most common complaints about smart city applications, that they espouse only a single development model. What they do have in common, however, beyond encompassing expansive views of 'smart city' development, is acceptance of urban competitiveness and the primacy of economic goals as intrinsic to the smart city concept.

Looking closely, there are a dizzying array of attempts at smart city formation and membership. As Hollands's contribution to this special issue highlights, there are all manner and scale of potential candidates. He highlights eight well-known examples.

Singapore's iN2015 (intelligent nation) project, Songdo, South Korea's purpose built, globally competitive, high-tech, environmentally sustainable, business city, or Guangzhou Knowledge City in China are designed to attract talent, skilled manpower and knowledge-based industries. Masdar City, in the UAE, is currently being designed as an 'oasis of the future' (quite literally as it is built in the desert) and intended to become the world's first sustainable, renewable, energy-powered cleantech cluster (Kingsley, 2013). In Scandinavia and Europe, Helsinki and 'Intelligent' Thessaloniki (Greece) are held up as examples of encouraging the development of new mobile applications utilising open data and using IT to increase competitiveness and sustainability, respectively (Komninos et al., 2013). In Europe, Barcelona, continues to be renowned for its Smart City Model and in November 2014 hosted its fourth Smart City Expo World Congress in as many years (see http://www.smartcityexpo.com/), while the Amsterdam Smart City initiative is held up as the example of how to retrofit a city to improve living and economic conditions and reduce carbon emissions (Hollands, 2015; Kirby, 2013).

An important takeaway from this list of smart cities is the tailored nature of their approach. The objective is not just as technology users but as shrines of economic development practice. Some are using the smart city title to gain status by offering annual events to newcomers wishing to take up the mantle of smart city development (http://smartcitiesportugal.net).

There is frequently an alliance between the prototype smart city builders and scholars discussing the phenomenon. Their perspectives come together under the umbrella of cities as machines for living. Both promote at least somewhat utopian visions based on technological fixes for those aspects of urban settlement and the concentration of human beings that make for human frustration and slow the flow of goods and services. The authors in this special issue are all aware of this perspective although some emphasise it more than others.

A special issue on such a nebulous topic can never be comprehensive, but authors in this issue place the smart city in historical context, provide concrete examples of smart city applications and point to arenas where the concept and practice differ from prior urban technological fixes. The authors also indicate where the urban technological fix, in both its historical and contemporary forms has failed—for example, in addressing equity concerns. They demonstrate that there is a difference between what we can measure and what we need to know. The limits of the smart city are created both by the

absence of data applications that could drive collective rather than individual solutions and by the inability to address intangible qualities of cities that both improve and detract from the quality of urban life for city residents. These critiques have been part of the discussions on the closely related topic of 'big data'.

Although the authors in this issue approach the subject of smart cities from very different angles, they generally agree that smart city technologies are ill-suited to solving the problems that lie at the heart of improving the quality of urban life. Poverty is not on the agenda of smart city planners. They may solve traffic problems, but it is not clear how they will regenerate failing schools or find ways to include neighbourhoods facing disinvestment. The contradiction between the promise of smart cities and its limited policy scope is aptly demonstrated in one of the most celebrated smart cities, Rio de Janeiro. The city, with its control centre filled with wall size computer monitors, can perhaps use forecasts of threatening weather to send out warnings of storm intensity thus leading to speedier evacuation. What it does not address is the question of why people build housing in such high-risk environments and what it would take to change this behaviour. In this instance, at least, smart city technologies deal with symptoms rather than the disease.

Several themes are evident in the eight papers composing this issue. They answer some important questions about what the concept of smart cities is and isn't and what it can and cannot do.

What is a smart city?

What do people mean by the term 'smart city'? A casual search of the web turns up thousands of references to the term. Some define the smart city as an urban environment that is elegantly efficient, grander than the messy urban environments we live in today. For firms in the business of selling controllers, sensors, and servers—the technology to drive smart systems—the smart city is a new market for urban management. It is an urban form to be sold, resold, modified or augmented to make money. Many analysts and practitioners, however, are more modest in their definitions, limiting 'the smart city' to a few approaches that use publicly available data to solve discrete problems, such as waste management and traffic control.

The authors in this special issue have different perspectives but define the smart city by two essential attributes. First is the use of technologies to facilitate the coordination of fragmented urban sub-systems (for example, energy, water, mobility, built environment). Becoming 'smart' by subsystem improvement is assumed to be associated with new employment opportunities, wealth creation and economic growth. In a second and more futuristic definition, smart cities are urban places where the lived experience calls forth a new reality.

There are, in fact, few finished examples of greenfield sites that represent full deployment of the idea. As Carvalho (2015) details, even the less encumbered greenfield models such as Songdo or Masdar City, took so long to roll out that the political will deteriorated and the original impetus slackened across political cycles. As Shelton, Zook and Wiig describe, the fully formed greenfield smart city will be the great exception (Shelton et al., 2015). Most smart cities are about fixing things by adding off-the-shelf technology to existing functions such as transportation planning to make existing systems more efficient, predictable and, in rare cases, redeployable with re-programming. In the vast majority of cases, smart cities are about renovation rather than about building wholly new urban environments and, as such, they will all be different because of the exigencies of municipal budgets and political choices.

From the ethereal to the pragmatic, Rob Goodspeed suggests smart city definitions bifurcate, with one strand emphasising urban

and economic development, while the other focuses on government's use of technology for public sector operations (Goodspeed, 2015).

The limits of agreement around the concept arise in part because, as with prior moments when the rate of economic growth has stumbled, economic actors look for new markets to deploy existing technology. They grope for a synthesis that will kick off a sustained round of job generation and capital investment. For example, one progenitor of the smart city, the 'intelligent city' dates back to the 1980s, another period of sluggish economic growth, when, following on the heels of the early 1980s banking crisis, economic development professionals searched for another source of lift in the economy.

Real-life applications

Putting aside the attention-getting greenfield projects and leaving for the moment the realm of critique, there is something new and potentially game changing in the technologies and interventions this phase of urban development provides. Unless economic turmoil and instability stops urban growth in its tracks, over the next 50 years we will live on an increasingly urban planet. According to research reported in the *New York Times* and supported by the Shell Oil Company and Singapore University's Urban Lab, by 2050, the United Nations projects that more than 65% of the world's population will reside in cities. This means that another 18 cities of 10 million or more population will be added to today's 23 megacities. Of the 41 mega cities over 10 million, projected by 2030, 13 will be over 20 million in size (New York Times and Shell Oil, 2014). Considering these startling projections, what do the papers in this issue have to say about the pragmatics of smart city experiments? Following the lead of Shelton et al. (2015), this collection of papers points toward "a more nuanced, situated understanding of how and from where these policies have arisen, and how they are taking root in particular places around the world" (14). The implication is that although data applications and technological innovations are exciting, their success will be measured in cities whose infrastructure systems are non-existent and where the governance capacity and funds for collective goods are minimal.

Are cities being better resourced in the process of getting smarter?

From mundane functions such as waste disposal and pot-hole patching to crisis hotlines and homeless sheltering, cities are finding new ways to use IT infrastructure and data. What makes smart city programmes different? As Rabari and Storper note in this issue, many of these new endeavours link cities with outside actors. One type of link is with foundation-sponsored initiatives, such as Code for America in the USA (Shelton et al., 2015). In another model, a quasi-governmental entity set up by the EU provides funds for technology implementation around energy and transportation. However, it is important to ask whether the new interventions are being funded by new resources? Is smart city technology diverting or augmenting public budgets ravaged by austerity?

CJRES's special issue on *Austerity in the city* particularly papers by Betsy Donald (Donald et al., 2014) and Mildred Warner (Warner and Clifton, 2014), highlighted the many ways that city funding was declining and functions were being subcontracted out to reduce costs. Where do the funds come from for smart city investment? It could be argued that, in a pre-austerity era, such interventions would have arisen and been paid for through normal budgetary processes. But these types of investments have to be examined in the light of municipal budget oscillations over the last decade of financial crisis, encompassing periods of severe austerity and those of abundance. Smart city interventions have to

be interrogated in terms of whether they are true innovations and provide new capabilities such as wiring districts for public Internet access. Or, by contrast, do they merely pay for deferred maintenance and what would otherwise be normal upgrading of existing public services, such as signage and automated notifications of transit schedules. How and in what ways do data-enabled interventions such as those to catalogue and address residential abandonment in cities, such as Cleveland, New Orleans and Detroit add value and potentially speed the process of re-investment? Following the money would provide a more complete picture of smart city benefits.

Are users the winners?

Who is benefitting from smart city investments? Although smart city technology investments are mainly comprised of upgrades rather than true innovations, on the citizen user side, they potentially offer access to information on local conditions. They can afford communities and interest groups the opportunity to identify negative conditions and the potential to improve the urban experience. Realising these potential benefits, however, depends on the intent of the intervention. Offenhuber's contribution alerts us to the fact that the design of an intervention has significant implications for its usability and accessibility and that each design gesture has an intended community. For tech-savvy city dwellers, the design of an intervention can be open and mutable; knowing your audience is an important design consideration. By implication, what Offenhuber's paper also highlights is the degree of know-how and collateral resources required to use smart city interventions. The assumption behind many of these innovations is that everyone owns a smart phone and knows how to operate it at maximum performance. Technology audits are necessary to reveal just how flexible, usable and accessible these technology designs are.

And then, there is the mundane. In some of the biggest cities of the world like Dhaka, Bangladesh something as simple as a transit map is missing. Although certainly not cutting edge technology by today's standards, the innovation described in Zegras's paper highlights how something like a map 'opens up a city' giving life to spaces that are otherwise obscured. The absence of something as basic as a map of the transit system tells us how far we have to go to make technology available for the purposes of basic navigation. It also tells us that the smart city innovations being developed for high-prosperity cities are light years ahead of the fundamental needs of most of the world's urban populations (Zegras et al., 2015). For, to have a map is like having a light. You can do things and go places otherwise unattainable.

So, to really understand and gain insight from smart city interventions, we need more than the paucity of comparative work upon which much of the smart city narrative currently rests. If we are to avoid wasting scarce resources and propagating one size fits all policies and programmes, we need thoughtfully designed, rigorous comparative research. Only this will enable us to venture seriously beyond a level of understanding that consists of snippets from iconic places. Several of the authors in the special issue caution against generalisations based on the incomplete written record about smart city interventions. Perhaps, Carvalho goes the furthest in his critique of the existing record. His interviews with key actors in South Korea and Portugal reveal the initial naivety of smart city planners who assumed that the meaning and consequences of the technologies could be understood in the absence of human engagement at the phase of design. His case studies highlight the myriad impediments arising out of the design process and reinforce the idea that technology implementation requires user interaction in order to match conception with user experience. In other words, design

without the user leads to interfaces that do not address reality.

As both Carvalho and Kitchin suggest, we need more thoughtful comparative work in order to reveal the discursive and material realities of actually existing smart city developments. The authors in this special issue make significant progress toward this goal and demonstrate what we can learn from opening up the discussion about smart cities. These efforts could be built on through a series of comparative studies that contrast the experiences of different cities—both cities in which we might expect similarities in initiatives and effects (for example, cities of roughly the same size in the same jurisdiction) and those that we might expect to differ but are presently discussed as if they are similar (for example, cities in the Global South and North, or greenfield and retrofitting developments). The former would enable the particularities of smart city initiatives and their effects on economic development and regimes of governance to be teased apart. The latter would reveal the ways in which smart city rhetoric and implementation are being produced and grounded in quite different contexts and the ways in which the concept travels and mutates.

Is the smart city movement capable of delivering better urban living?

Although we can debate what 'better urban living' means, clearly the commercial side of the smart city movement is promising a great deal. Companies like IBM initially claimed that investing in sensing technology would yield safer, cleaner and more efficient urban areas. Their marketing was directed at an upper middle class, experiencing losses of time and income from urban inefficiencies and urban policymakers desiring to make points for urban innovation. However, more recently, recognising that their class-based appeals were endangering smart city marketability, companies including IBM and CISCO have "started to alter the discursive emphasis of some of their initiatives from being top-down managerially focused to stressing inclusivity and citizen empowerment" (Kitchin, 2015, 133).

Commercial interests are also taking more risks with and stepping out in critiquing urban suitors' unbridled desire to be selected as the next Intel, CISCO, IBM or other purveyor of smart city development. In an *Economic Times of India* interview with Intel's South Asia Debjani Ghosh, vice president, sales and marketing group, Mr Ghosh (2014) cautions that

> execution, which has been a challenge in India, will be crucial. India is going to have multiple Smart Cities and different models for each city. For Smart Cities, we should not look at technological modernization, rather look at how to enhance the culture and heritage so that more people come to these cities. Greenfield is the more practical approach. But again you need to look at the problems. For instance, Varanasi, which is a tourist place and should be clean, but it is not. There is huge problem with the entire waste disposal system. You also need a local industry because people need to have employment. A Smart City is something when young people don't want to leave the city for employment. So, you have to ensure that there's enough local opportunity available to keep them engaged (*Economic Times of India*, 4 December, electronic edition; accessed 7 December 2014)

Thus, even the strongest advocates and primary beneficiaries of smart city technologies perceive the limits of unbridled enthusiasm.

However, looking beyond the commercial to the social, political and economic implications, citizen movements have demonstrated the ability to successfully adopt and adapt the core of smart city technologies to engage in public debate and to advocate for urban improvements. Community and non-governmental organisations also have been

adept at utilising the vast amount of data now available from myriad sources of government, private and not for profit organisations such as "Open Plan, a group that provides community-edited directories of public meetings; open-source platforms for local news gathering; applications to help agencies 'crowdsource' streetscape improvements; and forums for city transportation officials to share best practices for urban bikeway design (OpenPlans, nd)" (Rabari and Storper, 2015). Cities are being approached by technology companies in the hope that the cities themselves can identify the uses for smart city technology interventions (Carl Spector, Director of Climate and Environmental Planning for the City of Boston, 5 December 2014, personal interview). Thus, as is often the case with technological change, the producers can't dream users into existence, but instead uptake requires learning by doing through collaboration and risk sharing. Beyond making cities more liveable because their inner political workings are more accessible, local organisations are building tools to make 'sensibility' real, using devices such as Carlo Ratti's City Lab's algorithm, which integrates crowd sourced data from cell phone users who are seeking to track night life hot spots.

But does this constitute better urban living? Along with technologies that allow us to track concentrations of like-minded people on a Friday night, how much of the smart city research is being directed toward questions of groups in society unlikely to be consulted or enabled to use the sophisticated facets of a cell phone? What of the elderly, the disabled, the economically and socially isolated? Offenhuber's maps of Boston and the use of the 311 data clearly highlight the absence of cell phone signalling from the city's lower income neighbourhoods. Is it just that low-income neighbourhoods don't have trash or pot-holes or is it that residents don't care about trash on their streets, the presence of broken street lights or the existence of pot-holes? Or are they in need of transit service extended in their community or frequently available buses to get from home to work and back (Offenhuber, 2015). In other words, do they need different data altogether? Rabari and Storper (2015, 32) point out: "The core, underlying promise is that more information will improve the experience of urban social life and lead to the creation of many useful and efficient services". The question is, is that promise made to everyone, is the conception of the 'smart city' inclusive or does it, by the very nature of the data it relies upon, exclude important groups in society?

In the smart city case, the intention is all important. Adding to Kitchin's call for research on smart city interventions themselves, we would add that there is a profound need to form research around the multiple user communities of our future-'sensored' cities. Although the promise of inclusivity is showing up in the reconfigured rhetoric of commercial proponents, such as IBM and CISCO, they are only one promulgator of smart city rhetoric. City leaders are as involved in producing the narratives that promise the moon as are commercial interests. Given their civic responsibility to create and apply programmes targeted toward the diverse array of urban social groups, city leaders are also accountable and should be held accountable in the pursuit of the status of 'smart city'. They are responsible if designs for the future city have only the most skilled, most tech-savvy residents in mind and ignore citizens who may not own the necessary technology or who use it solely for functional purposes. Research on broadband technology demonstrates that the technology is pervasive, that there are few places in the USA where a cell tower hasn't penetrated. In a parallel example, in the USA, what limits effective broadband penetration is not the technology itself, but its cost and the capacity of the user community to explore and fully utilise the technology (Glasmeier et al., 2003).

Final thoughts

In conclusion, we offer a word of advice to armchair critics. As Kitchin rightly suggests, if we academics wish to see smart city development and rhetoric take on bigger questions and pursue more socially relevant uses of new technology applications, then it is incumbent upon us to conduct the collaborative research that helps us the practitioners understand: (i) what the technology can and cannot do; (ii) what the application deployment conditions are (scale; proximity; density; market size) and (iii) how far off applications are from widespread marketability. These three are surely minimum conditions. The point is that we can't just lend critique to the situation. We have to be willing and able to get in, roll up our sleeves and discover how new applications and technologies can be used to genuinely improve the quality of urban life. Otherwise, we can't complain we were locked out of this moment.

Estimates are that 2.6 billion people will move to or be born into urban centres by 2050. Two-thirds of these residents will live in Asia or Africa. Left untouched, many of these cities will emerge out of or swallow-up squatter settlements (New York Times and Shell Oil, 2014). Water, sewer, transportation, electricity, telecommunications, housing, health care, education—all of these functions—will have to be built from the ground up. Smart city discourse is largely looking into the immediate future and at places already known and functioning. How and whether the scholarly community contributes to the evolving discussions of the city of the future will rest on our ability to produce solid, detailed and effective empirical studies of this process of urban transformation. Are we up to the task? Is the current characterisation of smart cities going to inform our understanding of the real cities of tomorrow? The pace of change is forecast to be so swift that unless efforts begin now to provide solid research findings, the opinions and advice of scholars are likely to have little effect or impact on these cities of the future. Perhaps this issue can serve as a jumping off point to an intelligent discussion about the cities we want in the future and whether and how smart city technologies are likely to provide them.

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