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Towards more inclusive smart cities: Reconciling the divergent realities of data and discourse at the margins

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Abstract

In this article, we survey a growing body of literature within geography and other intersecting fields that trains attention on what inclusive smart cities are, or what they could be. In doing so, we build on debates around smart citizens, smart public participation, and grassroots and bottom-up smart cities that are concerned with making smart cities more inclusive. The growing critical scholarship on such discourses, however, alerts us to the knowledge politics that are involved in, and the urban inequalities that are deeply rooted within, the urban. Technological interventions contribute to these politics and inequalities in various ways. Accordingly, we discuss limitations of the current discourses around inclusive smart cities and suggest a need for a nuanced definition of 'inclusiveness'. We also discuss the necessity to further engage with critical data studies in order to 'know' what we are critiquing.

KEYWORDS
smart cities, inclusive smart cities, bottom-up smart cities, *just* smart cities, smart citizenship, urban, inequalities

1 | INTRODUCTION: WHY 'INCLUSIVE' SMART CITIES?

Over the past two decades, various smart city initiatives have developed and normalised a discourse that digital infrastructures can ameliorate existing urban problems. At the same time, critical scholarship has reminded us of the interlinkages between smart cities, neoliberalism, and dystopian techno-visions of the future (Karvonen, Cugurullo, & Caprotti, 2018; Cugurullo, 2013; Cugurullo, 2016; Kim, 2010; Shwayri, 2013; Shin, 2016; Hollands, 2008; Kitchin, 2015; Luque-Ayala & Marvin, 2015; Wiig, 2015; March, 2018). In response, there has been consideration of

how smart cities can be more inclusive so that they are no longer planned and mobilised based on a profit-driven vision, but rather on a contextualised one that is applicable to the actual lives of the citizens. Ideally, these visions are to be informed by the voice of the public to be 'citizen focused' and 'community focused' (Cardullo & Kitchin, 2018a; Datta, 2018).

Whilst there is an implicit value to smart cities being imagined as inclusive, we need to ask why 'inclusive' smart cities are necessary and desirable, and in which context and for what reason (March & Ribera-Fumaz, 2016; Wiig, 2015). We contend that the phrase 'inclusive smart city' has often been misinterpreted as being inclusive of every segment of the population, without considering people's choice or having become aligned with the concepts of scale, economic growth and expansion. Instead, we argue that inclusive smart cities should be evaluated as to whether they are equal and liveable. Although inclusiveness in the sense of equity is not always central to the policy rationale or functionality of smart cities, the questioning is crucial for scrutinising the 'black box' of smart cities, the politics of knowledge production (Fischer, 2000) and how pervasive and manipulative data can be (Leszczynski, 2016) in the name of making an 'inclusive' and liveable smart city. In this sense, there is a need to highlight the knowledge politics embedded within the discourse by questioning what participatory democracy and data transparency really mean in the context of the smart city. By way of extension, there is also a need to disentangle and acknowledge how the different levels of, and pathways to, power can shape, and re-shape our existing interests and knowledges towards political decision making (Fischer, 2000).

In this article, we contribute to the ongoing development of the notion of 'inclusive smart cities[1]' in ways that better serve the purpose of recognising, critically understanding, and conceptualising smart cities that are framed according to fundamental notions of equity, justice, and liveability. We refer specifically to the growing bodies of literature on data transparency (Kitchin, 2014; Burns et al., 2018) which re-define the publicness of smart cities (Cowley, Joss, & Dayot, 2018) and humanise smart urbanism (Kitchin, 2018) through, for example, the lens of gender (Datta, 2018). These literatures address the unequal production of, and access to, big data and related infrastructures of smart cities. They also tackle the question of how smart cities perpetuate the reproduction of urban inequalities even within the imaginations of being 'smart' and 'inclusive'. By way of 'humanising' smart cities, these literatures must continue to push the boundaries of inclusiveness if they are to foreground the radical reconfiguration of the smart city as a public-led vision that can give a voice to otherwise silenced digital 'subjects'.

In what follows, we first outline a set of studies which examine smart citizenship. From there, we refine a number of themes that have emerged within the growing literature. Second, we move onto a set of studies that examine the 'actually existing' smart cities such as bottom-up and grassroots smart cities. In the final section, we discuss the limitations in the current discourse around inclusiveness and attempt to re-define what we mean by inclusive smart cities. We do so by introducing a more nuanced understanding of inclusion as a way of reconciling divergent realities of data and discourse at the margins. We conclude by discussing how the current literature alerts and navigates us to a pathway towards critical thinking about inclusive smart cities that are aligned with notions of equal rights and access, justice and liveability of citizens. We also suggest a new area for further research so that geographical scholarship can critique and contribute to creating inclusive smart cities in both theoretical and practical ways.

2 | SMART CITIZENSHIP

'Citizenship' encompasses concepts of not only identification and belonging, but also power, control and politics (Cresswell, 2013). By adding the aspect of 'smart' to the politics embedded within citizenship, we can start to see the extent to which smart citizenship can be construed as an exclusive construct that can be divisive and potentially problematic. By taking this stance, we can problematise and question the exclusionary underpinnings that smart citizenship discourses make. We can also begin to understand why they are still far from being 'inclusive'. In this section, we discuss how 'inclusiveness' within the context of discourses of smart citizenship has diverged from the (implicitly more realistic) realm of public policy and practice. We outline a number of critical studies which scrutinise exactly

how smart citizenship engagement has been put into action at various city and state levels and how it has shaped the policy and urban infrastructures involved (Cardullo & Kitchin, 2018a, 2018b; Datta, 2018; March & Ribera-Fumaz, 2016).

2.1 | Active versus inactive

Smart citizenship generally refers to civic engagement via technology whereby cities can be co-designed and co-created in a civic, inclusive and transparent manner. It is also a policy vision wherein urban citizens are encouraged to play a key role in the collective production and administration of the city (Roy, 2001; Datta, 2018; Luque-Ayala and Marvin, 2015; Kitchin, 2018). Such visions of smart citizen engagement are laden with discourses of inclusion and transparency. These visions are aided by the 'publicness' of smart cities, enabled by the increasing availability of public data in supporting entrepreneurship as a means of revitalising the local economy (Evans, Jones, Karvonen, Millard, & Wendler, 2015; Evans, 2016; Bulkeley et al., 2016; Pollio, 2016; Crivello, 2015). For instance, Dowling, McGuirk, and Maalsen (2018) illustrate how a smart city in Newcastle, Australia, was rolled out through a collaborative effort by universities, young entrepreneurs and local agencies instead of by big companies.

Often, however, the reality is that big private companies are the key players, and when they roll out smart cities, questions surrounding data unevenness arise: whose perspectives are data collected from, who has access to the data, who determines what data to collect, and in whose interests. For instance, Cisco in Songdo and IBM in other smart cities have been variously criticised for bringing in technological infrastructures while taking away the local financial asset, without bringing much impact to the actual lives of the city's inhabitants (Hollands, 2008; March & Ribera-Fumaz, 2016).

The problem, therefore, is that while public data may be made available, that data, and the city it produces, is shaped by, and targeted at, the urban elite (Pollio, 2006; Shelton, Zook, & Wiig, 2015; Crivello, 2015). The technologically illiterate and the poor risk being marginalised, and the digital spaces that emerge from smart citizenship act as a functional separation between 'sealed-off technological enclaves and leftover marginalised spaces' (Vanolo, 2014, p. 891). The 'digital divide' (van Dijk, 2006) is a central concern. That apprehension should become even more prevalent as cities are being shaped through technology and are producing digitally inclusive or exclusive spaces (van Dijk, 2006). However, the 'digital divide' is not just between those who have and do not have access to the smart technologies, and further thought is required and must be expanded in regard to the marginal and socially vulnerable. The division between active and inactive smart citizens in the current literature has been treated in a rather simplistic manner. There is a need to further interrogate autonomy and agency within the purview of participating and non-participating smart citizens, and one must determine under exactly what circumstances the division may exist.

2.2 | Competition and neoliberal citizens

The narratives of 'participatory' and 'civic' engagement have increasingly become part of the marketing strategy undertaken by public officials who are advocates of technocratic advancement (Angelidou, 2014; Grossi & Daniela, 2017; Kourtit, Nijkamp, & Steenbruggen, 2017; Wiig, 2015; Young, Ash, Kitchin, & Leszczynski, 2019), but the reality of practice is also increasingly being questioned. For instance, a case study of smart citizenship as a new participatory mechanism in the city of Barcelona suggests that 'while the Smart City concept appeals to the central role of the citizen and boasts of opening up new participatory mechanisms, behind these strategies there is an increasing presence of big ICT, consultancy firms and utilities that search for new business opportunities' (March & Ribera-Fumaz, 2016, p. 826).

Despite attempts at making smart cities 'citizen-focused', smart urbanism remains rooted in rational, functional and paternalistic discourses instead of social rights, political citizenship and the common good. In other words, within

the inclusive smart city paradigm, the city not only brings services to its people but in so doing generates local business and economic prosperity in the long run. As a result, it creates 'neoliberal citizenship' (Cardullo & Kitchin, 2018b). Smart citizenship participation has also been critiqued as a 're-branding exercise' of smart cities (Kitchin, 2015) and even as an empty signifier (Cardullo & Kitchin, 2018a). Such criticisms are directed towards those technocratic public authorities and large technology companies who view the city as a market that can be managed and optimised via technology.

Smart citizenship engagement has been deployed as a strategy through which local government authorities can '(re)brand' their city as an inclusive smart city (Pollio, 2016). It is a common trend for local cities to compete for state funding to be the next 'citizen-focused smart city', as exemplified by cities in India (Datta, 2018) and by Toronto (Bunce, 2004). This competitive tendency creates rivalry and sets sometimes unrealistic goals for creating an image that the city is citizen focused. Such a strategy is embedded within 'austerity' politics (Bramall, 2013; Schui, 2014; Blyth, 2015; Pollio, 2016) which further emphasise that funding and resources are always limited. Therefore, not everyone can benefit from the smart initiatives, but each and every city has to actively compete against others for state funding. Hence, to be desirable, the smart city initiative has to be economically sustainable. The 'civic engagement' and connection with the local community merely remain as 'nice to have' soft policies for an inclusive branding.

2.3 | The myth of smart inclusiveness

So far, we have shown that the idea that 'smart citizenship' can create 'publicness' and open up an array of opportunities for the local citizens remains a myth. The current literature explores how inclusive smart cities mainly exist in an ideological sense and how they have failed to materialise in the realm of actual public engagement. The logic of the (neoliberal) smart citizen is a 'global agenda driven from the North, and the hegemonic image of the technologically advanced city as the most desirable typifies the modernisation paradigm' (Ordendaal, 2018, p. 246). Datta (2018) argues that there is an even greater ideal vision that the quality of life in India's smart cities will be similar to that of the European standards. This standpoint highlights the aim of Indian smart cities as setting for themselves the boundaries of western modernity and urbanism. 'Smart citizenship thus emerges at the moment in the large-scale transformation of India's economy when a new individualist and consumerist identity has begun to take hold across different social groups' (Datta, 2018, p. 408). Datta (2018) goes on to argue that smart city urban development and planning in India, sparked by middle-class privilege, would inevitably produce an uneven distribution of networked spaces. The result would be a socially and physically uneven urbanism.

For now, 'smart citizenship' engagement is but a policy vision and a marketing strategy to create an image of the city being inclusive. That is to say, it is an online platform that passively waits for 'urban smart citizens' to share their local knowledge and vision for the future on behalf of their community. On the other end of the spectrum, real smart citizenship engagement can be exemplified through 'smart activism' or 'cyborg activism'. For example, one study shows how the marginalised people living in publicly owned land in Cape Town vocalised their 'Land for People not Profit' activism using social media and smart technologies (e.g., real-time photo essays and hashtags) to fight against the state's plan to sell their land (Ordendaal, 2018). The assemblage of advocacy, grassroots movements against urban gentrification and smart technologies results in a true 'participatory democracy' that is aligned with the notion of 'right to the city', equality and justice. More recently, there has been a call to search for 'alternative modes' of digital development based on a study in Barcelona's grassroots smart cities whereby informal and organically developed networks of corporations, communities, and associations work towards forming a technological sovereignty movement which formed new arrangements of urban life and democratic decision making in the city (Lynch, 2019). Looking into such ongoing processes of alternative modes of digitalization goes beyond the well-established critique of smart cities.

In order for smart citizenship participation to be truly 'citizen-focused', change needs to happen in a way that allows for the transfer of power to be meaningful for *all* citizens. Such power is rooted in the 'right to the city' debate and in ideas beyond the market-driven interests of smart cities (Cardullo & Kitchin, 2018b). Despite being implemented at the urban, local, and individual scale through citizenship engagement, studies indicate that the assimilation and diffusion of smart city initiatives, along with the actual technologies and decision-making processes, are still defined by institutions that operate at a larger scale. Kong and Woods (2018a) illustrate how smart urbanism is 'plagued' by the paradox between access and choice. That is because 'smart urbanism only works if its key beneficiaries – the inhabitants of a city – choose to engage with the enablers of a smart lifestyle' (691). At this point, the discourses around smart citizens seem to undermine the inclusive smart city initiative. That is because they are dominated by exclusionary and divisive concepts that only heighten the already existing social inequalities. Below, we discuss how these inequalities may be reconciled through bottom-up smart cities in a way that can create new opportunities for inclusion.

3 | GRASSROOTS AND BOTTOM-UP SMART CITIES

In expanding the discourse around inclusiveness, the current scholarship has turned attention to questions like: What about the really marginalised segment of the population that is not even part of this growing discussion of the public/private, global/local, digital/human praxis? What about the people who cannot afford to purchase a smart home gadget or a smart phone or a computer and who do not have the 'digital right' (Datta, 2018) to the city—not by choice but by their circumstances? What about the disabled person who would never be physically able to enjoy equal access to the smart-cycling infrastructure that may be owned by the 'public'? Social polarisation within the digital future is often positioned within the 'looming background' of economic growth and efficiency of smart cities (Hollands, 2008; March, 2018; Sterling, 2018; Tonkiss, 2018). In this section, we turn to some of the emerging literatures on inclusive smart cities which are focused on either helping or serving the social needs of the marginal segments of the population.

3.1 | Actualising 'inclusive' smart cities at the margins

The logic of redefining, materialising, and 'actualising' (Shelton et al., 2015) is to step away from being too critical and thus hollowing out the actual notion of the smart city. The idea is to understand the complexities behind smart cities as assemblages of different political agendas, ideologies and actors that are in place to push for positive technological impacts on the lives of citizens and for the good of society (Kitchin, 2018; Shelton et al., 2015). It is about understanding the newly emerging 'smart practices' in a tangible and intangible manner (Neirotti, Marco, Cagliano, Mangano, & Scorrano, 2014) and actively searching for what 'smart cities produce or allow to be done differently [and] how [that] reconfigures the urban' (Veltz, Rutherford, & Picon, 2018, p. 134). While cities such as Songdo and Masdar have failed to implement their original masterplans fully, scholars have argued that it is important to understand how the smart city paradigm, as a policy and new ideology, has become 'awkwardly integrated into the existing social and spatial constellations of urban governance and the built environment' (Shelton et al., 2015, p. 14).

Several studies have explored such integration. For example, in China, Lin, Zhang, and Geertman (2015) argue that while the mode of e-governance has produced a social sustainability, thereby forming the basic relationship among the state, market and society, rural migrants and other marginal social groups are excluded. Using migrant communities in rural areas in China as a case study, they introduce a new web-based planning support system that can generate smart governance for people at the margins (Lin et al., 2015). Another study of migrant communities in Toronto (Rosu et al., 2017) introduces a new web-based service which is designed to give support to low-income migrants. For instance, the web connects middle-income families who may want to discard their home goods with

the low-income migrants who may be in need of such items but cannot afford to buy them. Through a complex computational system and using artificial intelligence based on the large dataset, the web service promises to connect the people who are willing to share their goods in a more efficient manner than the currently existing web services can provide (Rosu et al., 2017). Those types of studies tend to be university-led projects, often initiated by schools with a technological background and extensive funding sources (Howe & Fox, 2017; Hussain, Wenbi, da Silva, Nadher, & Mudhish, 2015; Kim, Alfaro, & Miller, 2015). For example, the aging society is a pertinent issue globally (Moser, 2013; Trencher & Karvonen, 2018), and in Singapore, a project has been initiated by Singapore Management University to develop smart home technologies that can help assist elderly individuals who are living alone at home (Goonawardene, Lee, Tan, Valera, & Tan, 2018; Kong & Woods, 2018b).

However, university-led innovations tend to remain as pilot research projects and never evolve into more. They also may not be solving the 'real problems' because they are driven by technological interests without considering the social and political factors or the actual end-user. It is uncertain how many people would actually use these new services. It is also unclear how big the potential is for them to make meaningful partnerships and effective collaborations with various private and public stakeholders to carry out their socially inclusive smart services at the city scale. It may take many actors from higher education institutions, venture capitalist firms, technology companies, and governments as well as more tacit knowledge for university-led innovations to bring a meaningful impact to bear and to become a catalyst for change (Addie, Angrisani, & De Falco, 2018). To this end, Woods (2020, pp. 5–6) recently argued that, in order to 'foster inclusion from the outset', there is a need to develop 'solutions that do little things that help to augment, and incrementally improve, pre-existing patterns, processes and paradigms' of urban life. The point here is that attempts to foster inclusion within the smart city should focus on small and incremental changes for the better, rather than transforming the urban in new, unpredictable, and potentially divisive, ways.

3.2 | Prescription and temporality

In the processes of 'actualising' smart cities at the margins and creating 'do it yourself' smart city innovations, conflicts of prescriptive logics, and rhetoric of temporality arise. A lot of the social innovation rhetoric can be found in the grassroots-led smart city initiatives. For instance, a study by Shelton et al. (2015) shows that the local government authorities in Philadelphia have been undertaking a digital-inclusion effort to provide Internet and technical education to the low-income and digitally illiterate residents. In doing so, they armed these individuals 'with the skills to be competitive for jobs in the 21st century information economy' (Shelton et al., 2015, p. 19). What the study found, however, is that the jobs targeted for offering to these low-digital-literacy residents were located far from the poor neighbourhood. Hence, even if the marginalised people were trained and offered these 'technical' jobs, their everyday commute was too difficult to enable them to actually accept the job offer. This tendency shows that the project aimed at lessening the 'digital divide' missed the 'bigger picture'. Such an oversight cannot be solved through technology. Moreover, sometimes a lot of the bottom-up movements seem to just 'scratch the surface' without making much impact on governmental intervention (Shelton et al., 2015). That is because authoritative instrumentalism and a paternalistic view still exist which strive to produce a 'known', desired outcome (Shelton et al., 2015; Shore & Wright, 2011).

Critical scholarship within geography alerts us that 'making smart cities for the poor' is not always the right answer. That is because such cities will only solve short-term problems. Hence, in the name of making 'inclusive smart cities', the project may 'thrive for a few years and then fade away due to lack of funding or interest by residents' (Trencher & Karvonen, 2018, p. 272). At their current stage, the small innovation projects aimed at reducing social inequality and directly improving the lives of the vulnerable population are seen as an 'alternative' option. Such an option is not aligned with the state government's smart rationalities of making an economically viable, self-sufficient city. These community engagement projects remain as 'nice to have' soft policies and may dissolve once they are branded as an 'inclusive smart city'. Then the majority of funding may get used elsewhere instead of on the people who are actually marginalised.

Furthermore, geographers argue that the projects and initiatives targeted specifically towards the socially and economically marginalised must be free of civic paternalism and stewardship, wherein companies and city authorities decide what is best for their citizens and deliver on behalf of citizens (Cardullo & Kitchin, 2018b). Instead, 'a larger understanding of urban infrastructure systems is necessary to move from data to information to knowledge and, ultimately, to action for urban sustainability and human well-being' (Ramaswami, Russell, Culligan, Sharma, & Kumar, 2016, p. 941). In other words, the existing urban inequalities of uneven mobility, uneven housing and living conditions, and unequal access to certain infrastructure and services based on people's class, gender, ethnicity, race, and income must be addressed first. This must happen before the 'smart intervention' takes place.

4 | TOWARDS MORE INCLUSIVE SMART CITIES

Overall, there appear to be divergent logics of speed and scale when it comes to citizen participation versus smart city initiatives. The former is slow, bottom up and 'inclusive', and the latter is fast, top-down and 'exclusive.' Yet, as we have discussed so far, such a dichotomy is arbitrary. That is because many of the currently existing 'inclusive', bottom-up smart cities are also conflated with the rhetoric of being top-down, generating neoliberal spaces, and are complicated by knowledge politics (Fischer, 2000). Instead, the question should be on *how* can we reconcile them in a way which many of the existing studies fail to capture. In this final section, we provide further critique of inclusive smart cities and propose ways to move forwards in achieving a more nuanced and critical understanding of inclusive smart cities. We propose that this be achieved, first, by redefining the discourses and epistemologies of 'inclusiveness' in smart cities. Second, it can be accomplished by engaging more critically with the studies of representations and knowledge politics of data in an attempt to 'know what we are criticising'. In this way, one can reconcile the divergent realities of data and discourse at the margins.

4.1 | Redefining the discourse: Emphasising autonomy on the margins

There are a number of limitations in the current literature that are concerned with social inclusion of the marginalised and socially vulnerable population in the smart cities narratives. First, the assumption is that an economic logic underpins the 'digital right' to the city. Such a logic may be the primary factor, but it's not the only one. As mentioned at the beginning of this article, the division between the active and non-active smart citizens has been treated in a rather simplistic manner. As such, there is a need to further interrogate autonomy and agency within the purview of participating and non-participating smart citizens. There is also a need to investigate under exactly what circumstances this division may exist.

Citizens may choose to be digitally marginal as an act of resistance or subversion. In terms of eldercare, for example, choosing not to engage with smart technologies is often based on elderly peoples' preference to be 'cared' for in more proximate, more relational and more human-centred ways instead of being cared for by smart technologies (Kong and Woods, 2018). With such insight, research could flesh out some of the assumptions and biases that are embedded within normative understandings about the 'margins' and the 'vulnerable'. The current discourses around inclusive smart cities turn to the marginal groups as a homogenous group that is vulnerable and stress that all marginal people should be included. Future studies can focus on interrogating what is meant by a marginal group and defining who is socially, psychologically, economically, physically, and emotionally marginalised or left out from the smart city's growth—and also how they can be spatially and temporally marginalised. Such plurality of 'margins' can also push us to clearly define why we should be considering such individuals. As discussed here, these refinements have not been achieved in the current discourse of inclusive smart cities. Furthermore, studies fail to define who we should be inclusive of and why. In rectifying this situation, we can begin to re-think the notion that inclusion in a 'smart' city is inherently good or desired. As critical scholarship has suggested, this assumption can be

problematic. One needs to identify and explain the (potential) benefits of a fully realised smart city and clarify why inclusion is necessarily desirable.

4.2 | Reconciling 'data' at the margins

Collecting data about the city in order to make better urban and policy decisions has existed for many years. However, within the context of smart cities, 'data' means large amounts of data collected through ICT technologies and sensors that are then analysed by machine learning and AI that signifies the 'objectivity' of data. Hence 'data' in the context of smart city has been associated with urban efficiency, better insights, and better planning and objective policy making. It is within the critical understanding of data analytics that one can start to critically think about the role/s of data in 'fully' realising a smart city—from collection, to analysis, to response. Such a perspective can also allow researchers to gather the potential for inclusion/exclusion to be reproduced and/or overcome in the data assemblage of smart city making. Critical geographers have been at the forefront of challenging the 'objectivity' of big data and have commented on its manipulation of and situatedness in smart city knowledge politics. They have also stressed the need to bring 'data transparency'. By way of looking at the data through a critical lens, we can problematise the fact that while the city becomes more transparent or predictable, the problem lies in the fact that it is also liable to be manipulated by those who collect and use the data (Ash, Kitchin, & Leszczynski, 2019; Kitchin, 2014).

A closer examination of data alerts us that smart cities are reproducing urban inequalities in a new way. This is not a novel claim, but as more and more smart cities are being rolled out with the next new ideal in urban planning initiatives, technological interventions are rationalised as the persistent norm in producing uneven geographies. For instance, in the process of sharing big data via public-owned entities and using certain smart technologies to map out city information, some neighbourhoods either get represented in a subjective manner (e.g., 'unsafe') or are ignored and left off the map completely. Studies argue that the reliance on big data to predict and control the future city diverts policy makers to the idea that cities must be securitised to prevent them from 'urban risk'. Such 'big data security assemblage', however, is often uneven, producing greater urban inequalities (Datta, 2018; Kitchin, 2014; Ordendaal, 2018; Shelton et al., 2015).

By way of example, a 'safety app' named 'Ghetto Tracker' is framed by racist thinking. It produces an explicit image which designates a certain neighbourhood as 'unsafe'. Such a label is 'highly speculative in orientation' (Leszczynski, 2016, p. 1698). The discussions around persuasive data are echoed by other scholars of digital geographies. These researchers attempt to develop a critical understanding of big data by emphasising (1) discussions around the politics of knowledge production, (2) *representations* of data technologies, and (3) the embeddedness of political and economic power relations within big data knowledge production (Burns, Dalton, & Thatcher, 2018; Elwood & Leszczynski, 2018; Fischer, 2000; Halphern, 2014; Kitchin & Kneale, 2001). Recently, a study of grassroots smart cities in Spain has shown how citizens at the margins are empowered by various collective digital grassroots innovations (Boni, López-Fogués, Fernández-Baldor, Millan, & Belda-Miquel, 2019). Based on four different cities in Spain, the study illustrates that Spanish citizens now can openly initiate their own networks and infrastructure via an open network system, which is supplemented by an open data system that offers transparency in the collection, analysis, and usage of data. Those new digital grassroots movements allow collective actions in searching and solving new shared problems. In this way, one could imagine 'innovation' not just in a materialistic form, but also symbolically through the new construction of citizenship and democracy (Boni et al., 2019).

4.3 | Directions for future research

While there has been a growing discussion on critically understanding the rationalities and functionalities of smart cities and on deconstructing the data assemblage, the methods of *how* to study smart cities have received relatively

less attention. Marvin, Luque-Ayala, and McFarlane (2015) have suggested, 'the ways in which the social, economic and political potential of smart urbanism is fundamentally produced with and through technologies remain beyond the reach of social science perspectives' (p. 3). Indeed, the social science perspectives often rely on methods such as tracing media, document and policy analysis and interviewing a wide variety of involved stakeholders. They do so as a way of 'tracing' and 'following' the processes and politics involved in the city's smart technology rollouts and data assemblage. These methods have their own merits and allow deep understandings to be gained about the causality and processes of smart cities or the end-user's experiences of living in and/or with the smart cities technologies. However, this means that they are ways of 'gazing' upon smart cities from the outside (Hollands, 2008; Marvin et al., 2015; Ordendaal, 2018). As Marvin et al. mention, they do not allow social scientists to understand or untangle the 'fundamentality' of technologies—or in the context of smart cities—to obtain deep understanding of the data analysis itself. Geographers have already begun this conversation and have seen an important relationship and overlap between software studies and GIS (Lally & Burns, 2017). They have called for critical geographers to work with the data and software GIS studies as a means of moving beyond the criticism and working together to produce critically engaged software technologies (O'Sullivan, 2019).

We argue that limited tools and skills are available within the social sciences to fully grasp what is happening within the 'black box' of smart cities. There is limited methodology in the social science arena. Other than 'gazing' upon smart cities from the outside (Hollands, 2008) through document analysis and interviewing different stakeholders who are involved in smart cities, the current work needs to become truly interdisciplinary. Only then can it fully tackle the epistemological and technical understanding of the data-learned and data-knowledgeable cities. Perhaps this would require an ethnography of the data scientists who are directly involved in making smart cities to learn their struggles, so as to bring humanistic expertise to the practical world of data collection (Neff, Tanweer, Fiore-Gartland, & Osburn, 2017). Or, one could imagine a group of psychologists, behavioural scientists, geographers, historians, and data scientists working together to answer how data could be used to solve certain social problems. Perhaps such interdisciplinary work might be too difficult for projects that are short-term or with limited resources, yet it is having certain kinds of 'algorithmic sensibility' on the humanistic side, and gaining humanistic and contextual mind-sets on the data scientist side that could be a beginning of a truly interdisciplinary project. In this way, critical scholarship can begin to not only critique but also contribute to reducing the continuous urban inequalities in which smart cities and the current indulgence over big data seem to be reproducing.

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ENDNOTE

[1]Discussion around inclusiveness in urban planning is not something new. However, it is our contention that in any given context, the definition of inclusiveness has been rather vague; hence further scrutiny is necessary.

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