Introduction

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The next urban paradigm: Cohabitation in the smart city

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The journal "it – Information Technology: Methods and Applications of Informatics and Information Technology" is the oldest German journal in the field of information technology. Perhaps it is thus quite fitting to use this esteemed venue to present the newest research in the urban computing field. I am pleased to present to you a special issue on "Urban Informatics and Smart Cities", which looks at the latest trends at the intersection of digital technology and its application to cities and the built environment. The special issue comprises five articles, which look at different opportunities, challenges, and trajectories on the horizon where computer science meets urbanism. Before I will offer my own prognosis and recommendation about the next urban paradigm, let me introduce the authors and their papers that after peer review were recommended for inclusion in this special issue. I am grateful to these four author teams for their stellar contributions that are certain to advance the smart city research agenda. I would also like to thank all colleagues who provided constructive feedback in their peer review reports.

First up are Martijn de Waal and Marloes Dignum with their article, "The Citizen in the Smart City: How the Smart City Could Transform Citizenship". This contribution has been placed upfront, as it is not only relevant to the scope of this special issue, it is also a timely and critical reflection of the smart city agenda's turn to the citizen. Rather than being vendor-driven and technocratic, the majority of stakeholders and city governments have started to come to the realisation that technology is just a means to an end. In the case of cities, it is pertinent for that end to be an improvement to the quality of life of citizens, to liveability, workability, and sustainability. De Waal and Dignum review seminal studies in the field, which makes for a great opening to this special issue.

The second contribution is by Rob Kitchin, Claudio Coletta, Leighton Evans, Liam Heaphy, and Darach MacDoncha, entitled, "Smart cities, epistemic communities, advocacy coalitions and the 'last mile' problem". This paper is particularly useful to those readers of "it – Information Technology" with a background in computer science and an interest in smart cities trying to make sense of all the buzz and hype that various advocacy groups and networks have been creating. Kitchin et al. cut through the complexities with a sharp analytical mindset that offers practical insights how smart cities could "become fully mainstreamed".

Next up we have a thought provoking paper by Jason Potts, Ellie Rennie, and Jake Goldenfein who bring a delectably transdisciplinary perspective to this special issue combining economic theory, media communication studies, and law. Research into information technology becomes the more exciting and impactful when it is combined with other disciplines, and this paper delivers just that: "Blockchains and the Crypto-City" looks at the opportunities inherent in distributed ledger technology for cities and proposes a radically new way of thinking about data decentralisation and urban disintermediation.

Finally, Anna Luusua, Johanna Ylipulli, and Emilia Rönkkö engage with arguably the most challenging of all humanity's challenges: climate change and sustainability. It has been well argued that cities may be the key to reduce our carbon emissions, to combat climate change, to create resilient cities, and to achieve genuinely sustainable forms of human life. In the paper, "Designing for a Post-Natural World: Nonanthropocentric Design and Smart Cities in the Anthropocene", the proposed pathway may not be what many expect, that is, to decentre the human in the design of smart cities. This move is also increasingly being echoed by other commentators and authors [4, 5, 13]. If we are to acknowledge the interconnected web of life and the more-than-human ecosystem that sustains us, we need to radically re-think not only our place in this world, but the way we create and impact on urban habitats.

I will conclude this editorial introduction with a brief review of five different development stages of smart cities, and their level of maturity when it comes to considering the needs and requirements of people and the environment. The habit of computer scientists to tag incremen-

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tal changes to software programs with version numbers has been adopted more widely. Terms such as Web 2.0, USB 3.0, and Industry 4.0 have become common parlance in business and everyday life. There are also various commentators [e.g., 3] who have applied this model to cities, and particularly the notion of the "smart city" in order to make sense of the fast pace of technological change. Most of these accounts go up to "Smart City 3". Here, I will attempt to provide a brief history of the smart city and add two more aspirational levels that we should consider and aim towards. This is also further corroborated by the ideas and contributions in the articles of this special issue.

1 City 1.0 – the roads, rates, and rubbish

The history of people coming together in cities has been studied in various disciplines such as urban studies, sociology, anthropology, geography, cultural studies, architecture, urban design. People move into and live in cities for various reasons. Cities can provide safety, shelter, food, employment, infrastructure, but more importantly: access to other people, which bring difference, choice, and diversity of thoughts, opinions, knowledge, skills. The diversity in cities is the engine of innovation and economic growth [1], and diversity is seen as a key factor of a city's success [10]. Global cities, such as London, Paris, New York and Tokyo, are contributing to world economic growth and innovation largely because of the cultural diversity of their populations [12].

In order for people to come together in cities and arrange themselves in far closer proximity than outside of cities, infrastructure is required, such as transport and waste management. Part of what cities also provide is public space. In the old days, cities included the commons, for example, a forest that the community looked after and used for firewood, foraging, and recreation.

City governments emerged from the necessity to provide infrastructure and public space, raise taxes and levies to look after and maintain them, but also to provide and enforce rules and regulations to govern the citizenry and their use of the urban commons. These days, this original rationale for city governments is sometimes referred to as the three "Rs" – the roads, the rates, and the rubbish.

2 City 2.0 – the smart city

Cities have always been hot houses for technological innovation, starting in ancient times with novel means to defend their city walls using advanced weaponry. These days, it appears cities have to defend themselves from different intruders: sales and marketing agents knocking on the doors of mayors, city CEOs and CIOs, and urban planners. After having been herding blue chip companies and global corporations as their cash cows since the 1970s, accounting and consultancy firms as well as software and hardware vendors have identified cities as their new target market. Their credo: the city as enterprise. Their product: the smart city.

The smart city and the miracles it promises such as reducing operating costs and resolving traffic congestions are driven by ubiquitous computing, mobile devices, sensors and the internet of things, and big data. The current hype around smart cities is about efficiency and productivity gains through automation and algorithmic analysis, and about growth.

This neoliberal and technology-led agenda has been met with criticism: The socio-cultural nuances of people have been studied for decades in urbanism and sociology, yet these findings have largely been ignored in the design of smart cities and smart city policies [7]. A city is not a computer [11]. And algorithmic culture risks "software-sorted" geographic polarisations and filter bubbles in cities to emerge, which in turn risk undermining a city's diversity advantage and innovation potential [6].

3 City 3.0 – participatory urbanism

Many early adopters of smart city technology, such as the South Korean "u-City" example [9], have come to the realisation that cities are about people, and the introduction of smart city technology should be informed by the user experience and led by people. In response to that, cities have introduced procedures to involve citizens in urban planning decision making. For example, participatory planning comprises community engagement phases that introduce new development proposals to citizens seeking their feedback. However, there are challenges: First, if the city is in favour of say, the new casino development to go ahead, there is a conflict of interest in dealing with citizen feedback that argues against it. Second, what channels are available and when, is up to the city government and can limit whose feedback is heard. Third, the often lacking closure of the feedback loop deters many citizens from engag-

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ing in such processes as it is unclear to them whether their opinion will matter or have any impact at all.

4 City 4.0 – city residents as co-creators

Progressive cities have come to realise that citizens can make great collaborators and co-creators. Many citizens already come together in groups to improve their neighbourhoods, suburbs and cities. They are engaged in parkour, yarn bombing or guerrilla knitting, dîner en blanc, park(ing) day, seed bombing and guerrilla gardening [8]. Yet, the responses so far vary from graffiti street artists who are commissioned in Melbourne to revive dated laneways yet persecuted in Brisbane for vandalism. Mapping these DIY urbanism and "urban guerrilla" movements can assist city governments in working together with citizens as co-creators in a collaborative approach to citymaking [2].

5 City 5.0 – cohabitation

So far, the smart city agenda is only starting to come to terms with issues of housing affordability, digital inclusion, and social justice. However, the list of challenges does not end here. Climate change already has a huge impact on cities with a notable increase in adverse weather events, and some thought leaders actively seek to reconcile the smart city with the resilient city (e.g., 100resilientcities.org). A pertinent question to ask is whether the people focus is in fact worth rethinking in order to imagine the post-anthropocentric city [4]. With a limited perspective that is only concerned about humans, we risk to forget other living beings, the environment, and the wider ecosystem that keeps us alive. My guess is that future generations will think that it would have been a smart idea now to create cities for cohabitation [13]. This may start with the recognition of the other living beings we share urban environments with and enabling them to survive and thrive, but should also include a commitment for humans and cities to make a net positive contribution to the world.

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Bionotes

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Marcus Foth is Professor of Urban Informatics in the QUT Design Lab, Creative Industries Faculty at Queensland University of Technology. He is also an Honorary Professor in the School of Communication and Culture at Aarhus University, Denmark. Professor Foth's research brings together people, place, and technology. His transdisciplinary work is at the international forefront of human-computer interaction research and development with a focus on smart cities, community engagement, media architecture, internet studies, ubiquitous computing, and sustainability. He founded the Urban Informatics Research Lab at QUT in 2006. Ahead of their time and before the term "smart cities" became popular, the lab pioneered a new field of study and practice: Urban informatics examines people creating, applying and using information and communication technology and data in cities and urban environments. Professor Foth received a Queensland Young Tall Poppy Science Award 2013, and was inducted by the planning, design and development site *Planetizen* to the world's top 25 leading thinkers and innovators in the field of urban planning and technology. In 2017, the Australian Computer Society (ACS) made him a fellow for "a sustained and distinguished contribution to the field of computer science. Foth is the international thought leader who coined the term urban informatics – now adopted by universities and industry worldwide. Foth's work makes clear how academic research can successfully respond to societal challenges".

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