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Article

Urban Connective Action: The Case of Events Hosted in Public Space

David McGillivray *, Severin Guillard and Emma Reid

School of Business and Creative Industries, University of the West of Scotland, Paisley, PA1 2BE, UK;
E-Mails: david.mcgillivray@uws.ac.uk (D.M.), severin.guillard@uws.ac.uk (S.G.), emma.reid@uws.ac.uk (E.M.)

* Corresponding author

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Abstract
In the past decade, significant transformations have influenced the governance of urban public spaces. There has also been a growth in new public spheres associated with digital media networks, informing and influencing the production and regulation of urban space. In this article, we explore the role of digital and social media as a form of connective action supporting public campaigns about the privatisation and erosion of public space in the Scottish city of Edinburgh. We draw on analysis of Twitter data, interviews and observations of offline events to illustrate how a broad coalition of actors utilise online and offline tactics to contest the takeover of public space, confirming that that the virtual and the physical are not parallel realms but continuously intersecting social realities. Finally, we reflect on the extent to which digital media-enabled connective action can influence the orientation of urban controversies debates and lead to material change in the way urban public space is managed and regulated.

Keywords
connective action; Edinburgh; festivals and events; public space; urban controversy

Issue
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1. Introduction

In January 2020, a public meeting was organised at Edinburgh Central Hall titled *City for Sale? The Commodification of Edinburgh's Public Spaces*. Initiated and organised by the civic heritage organisation, The Cockburn Association, this event focused on a new threat to the city's public spaces: Their closing off for extended periods of time to host major commercial events. Attended by 850 people, including several well-known public figures (a journalist from the national television channel BBC Scotland, and a Member of the Scottish Parliament from the Green Party), this event reflected significant concern from Edinburgh's residents about the use and management of public space in the city. The event focused on public space and its value, the role of festivals and events in the city, and the opportunity available to residents to influence decision-making in the way their public spaces are used. The meeting was also the culmination of months, if not years, of discussion and debate about the relationship between the Festival City (as it is often titled) and its environs. These discussions have taken place in physical meetings and gatherings, but more recently they have played out in the media and on digital and social media platforms. The Edinburgh case is an emblematic example of how, in the context of contemporary cities, online and offline collective action can unite to influence the way urban public space is managed and regulated.

In the past few decades, urban researchers have highlighted how the management and design of urban public space has become influenced by many, often contradictory, demands. These range from exposure to a neoliberal agenda that encourages the local state to commercialise its public and common good assets for economic return (Smith, 2016), to increased calls for the inclusion of local communities in the design of their urban environments (Aelbrecht, 2019). In the last two decades, the

emergence of so-called new public spheres (Papacharissi, 2002), associated with digital media networks, has introduced another layer to the urban debate. By creating a new 'skin' for cities (Rabari & Storper, 2015), the digital sphere is informing and influencing the production and regulation of urban space, especially when it comes to the mobilisation of citizens in the form of campaigns and protests (Arora, 2015; Molnar, 2014; Schäfer, 2015).

In this article, we explore the extent to which digital and social media platforms enable the expression of public concerns over the management, use and design of public space in the context of the growing festivalisation of cities (Richards & Palmer, 2010). It connects two areas of debate: The reconfiguration of the relationship between physical and virtual spaces, and the changing modes of production of urban public space, torn between new attempts to open them to diverse types of citizens and their promotion as assets in a neoliberal context. Empirically, we focus on the Scottish city of Edinburgh, which has long been considered an international festival city (Jamieson, 2014). Drawing on the urban controversies created over the use of the city's principal public spaces for festival and event-related activities, we address the following research question: How do online and offline politics operate in relation to discussions about the value of hosting festivals and events in urban civic public space, and with what effects?

Structurally, we begin by discussing the concept of 'connective action,' exploring how narratives of digitalisation can reframe local activism by providing new means to contest the management and use of public spaces. We then focus on how these digitally mediated processes interact with existing trends in the management and use of public space, especially where they reinforce and contest already existing processes of privatisation, commodification and festivalisation. We detail our single case study, before presenting empirical evidence on the extent to which offline and online politics were successful in initiating change in the governance of urban public space in Edinburgh.

2. Digital Deliberation and the Public Sphere: Connective Action in Operation

There is growing evidence of an "intersection and interaction" (Molnar, 2014, p. 44) between new communications media and physical space. Rather than the physical city being deemed obsolete, the virtual and the physical represent "continuously intersecting social realities" (Molnar, 2014, p. 44). While the development of digital platforms has been criticised for generating new forms of control and surveillance (Mortensen, Neumayer, & Poell, 2019), other work recognises the deliberative potential of digital and social media to enhance democratic participation, transparency and accountability. Schäfer (2015) talks of opportunities presented by a digital public sphere defined by open participation, the ability to discuss common concerns and discussions being more visible. The intersection and interaction between the digital and the physical are also evident in the sphere of contested politics, including protest movements. Arora (2015) makes the case for social network sites, as "centers of democracy and sites of protest" (p. 55). The social architectures of digital platforms can be powerful when they involve everyday social interactions that attract people who would otherwise be unlikely to join an advocacy group, or political party to express their discontent with local issues.

Bennett and Segerberg (2012, p. 743) coined the term connective action to reflect "digitally networked…engagement with politics as an expression of personal hopes, lifestyles and grievances." They identify the significance of digitally enabled action networks that allow for broader public engagement outside of more established party or movement concerns. They emphasise the importance of more personalised ideas and mechanisms, rather than social group identity, membership or ideology, utilising a wide range of social technologies to spread the word. Pond and Lewis (2019) build on this work, suggesting that connective action is a way to describe collective action "empowered by the 'logics' of social media" (p. 215) representing an "attempt to rethink the established logic of collective action for an age of hyper-mediated, personalised, political expression" (p. 213). It is argued that the architecture and codes embedded in social platforms enable collectivities to form at low cost and with (relatively) low risk for participants, which encourages the formation of these action networks. Pond and Lewis (2019) use the example of Twitter to highlight how its tools and practices, like retweeting and favouriting, encourage people to find those with similar political and personal interests, which form the basis of collective action.

Collective action logic has often failed because too few people agree on the public good that can be secured from working on a common cause, or do not make the contributions required to secure traction politically. Proponents argue that connective action frames can avoid this outcome because they are more accessible and individualised, eliminating barriers to entry and reducing costs, for both individuals and organisations. Well-established advocacy organisations are still important to connective action, engaging in what Bennett and Segerberg (2012) have called hybrid relations with other organisations to enable personal engagement through digital and social technologies. In this model, traditional organisational actors must avoid strong agendas and political brands in order to provide personal options in how people choose to participate and express themselves. As these publics share and personalise their content with trusted networks then the effects can be significant.

Despite the potential of digital platforms to facilitate connective action, there are legitimate concerns about equity of access, data privacy, increased surveillance, control and exclusion associated with the growth of these environments. Access to platforms does not guar-

antee equitable participation or influence (Van Deursen, Helsper, Eynon, & van Dijk, 2017). As Schäfer (2015) has suggested, even for those able to participate there is a danger that digital platforms encourage fragmentation into small communities of like-minded people, producing polarized views as opposed to producing greater diversity of opinion. Sunstein's (2007) work on online echo chambers and Pariser's (2011) consideration of filter bubbles further reinforce the need to be careful in overstating the democratic possibilities of digital platforms. The platform architectures used by organisations and individuals offer both possibilities and constraints, influencing how exchanges and connections take place (Poell, Rajagopalan, & Kavada, 2018). Haggerty and Ericson (2000) express concern at the surveillant assemblage that social media platforms contribute towards as private corporations generate digital profiles of users that help predict future behaviours and tastes (Zuboff, 2019). On most social media platforms, global conglomerates make choices "about what can appear, how it is organised, how it is monetized, what can be removed and why, and what the technical architecture allows and prohibits" (Gillespie, 2010, p. 359). Finally, critics also suggest that the possibility of a digital public sphere is compromised on social platforms by the often emotional, confrontational and agnostic nature of online conversations, working against rational debate online (Schäfer, 2015).

However, while there are clearly many limitations to digital media platforms as a route to an idealized public sphere, there is a recognition that marginalized actors and silenced opinions can be made visible in the online space. While the material effects of Twitter campaigns may be unpredictable, ephemeral and never guaranteed they can also capture the attention of political leaders and produce greater democratic accountability. How effective this process can be is the focus of this study.

3. The Uses and Management of Public Spaces: Privatization, Digitalisation and Festivalisation

The idea that public spaces are collectively owned and shared environments, where diverse publics can gather and express themselves has been subject to considerable critique in recent years. Urban literatures suggest that experiences of public space vary from one category of individuals to the other, along dimensions including class (Mitchell, 2003), gender (Hubbard, 2001), race (Low, Taplin, & Scheld, 2009) and age (Valentine, 1996).

However, accounting for the experiences of diverse populations in planning, designing and managing public spaces is impacted by powerful discourses which, at times, work against this agenda. As Smith (2016) suggests, urban public spaces are affected by three complementary threats. The first is securitization: This movement has increased in the past decades in the context of a global wave of neoliberal policies started in the United States in the 1980s and adopted afterwards in other contexts (Low & Smith, 2006). Securitization affects public space as open spaces are closed off from the general public, with an increased use of militarized (and more and more technological) devices aiming to create an impression of control. This has been reinforced by a process of privatization: Instead of being owned by public institutions, public spaces have been reconstituted over the past two decades as private or quasi-private environments, managed in the context of public-private partnerships, and operating according to commercial logic. Each of these threats has contributed towards processes of commodification. In a context of fiscal tightening, the local state has been (re)imagined as an entrepreneurial entity, and public spaces have been reconstituted as assets that need to be exploited for economic return. Drawing on the case of public parks, Arora (2015) suggests that they now frequently represent and reflect "corporatized, commercialized, and semiprivatized space" (p. 63), generating growing concern amongst those people living near, using and caring for these spaces.

Accompanying these three threats is the emergence of digitalisation. Early analyses suggested that digitalisation would accelerate the decline of public spaces. It was argued that the growing prevalence of online exchanges would turn public spaces into a succession of insular private bubbles not related to physical proximity (Frith, 2012). However, another body of work highlights how technologies can also help to revive public spaces as an arena of meaningful debate. Far from evolving as separate entities, in the merging of digital and physical spaces the former becomes a place where local matters are debated (Papacharissi, 2002), while the latter turns into a 'hybrid space' influenced both by offline and online dynamics (de Souza e Silva, 2006). Digital platforms are now regularly utilised by local governments to foster civic engagement in the design process of public spaces (Gordon & de Souza e Silva, 2011), but they have also been used by activists to generate collective actions which bypass official institutions. There is evidence that digital technologies can strengthen local involvement at the everyday political level: Neighbourhood groups, hyperlocal blogs or individual contributions on social networks are examples of ways through which concerned citizens now influence the debates on the future of urban public spaces (Gordon & de Souza e Silva, 2011). However, questions remain as to who exerts the power in these digitally deliberative processes with Gordon and de Souza e Silva (2011, p. 111) highlighting that the efficient use of technology requires:

> Being privy to the rules. It means knowing the best way to connect with neighbors and to consult politicians. It means not just having access to a communication tool, but knowing how best to use it for political and social gain.

The issue of festivals and events represents an appropriate context to explore the new relations between public space, privatization and digitalisation. Indeed, while

squares, parks and streetscapes have historically been a prime location for events such as fairs, markets, or carnivals (Smith, 2016), these festive happenings have gained a new prominence in the eventful city (Richards & Palmer, 2010) of the late capitalist period, where cultural and sporting occasions are increasingly tied to urban development strategies. While festivals and events can bring more visibility for marginalised groups in cities or generate new temporary social interactions, in their larger and more commercial forms they have been implicated as a representation of the crisis affecting urban public space. Critical commentators suggest that the normalisation of public spaces as event venues can contribute to the market orientation of urban environments, restricting access to spaces normally open to all or extending commercial logic by forcing attendees to pay for using them (Smith, 2018). Lately, the emergence of digital platforms has also led these criticisms to be expressed online: While digital platforms have been used by many festival and event organisers and sponsors to promote activities happening in public space, it has also often become a way through which a wider public can "enable the inversion of the power relationship between consumer and producer, opening up new avenues for the expression of protest and dissent" (McGillivray & Frew, 2014, p. 2660).

In the remainder of this article, we explore how these criticisms have formalised offline and online in a city defined since 1949 by its internationally recognised festivals. While festivals and events have become significant cultural, social and economic assets to Edinburgh, and to Scotland's place in the world, the city's dependency towards them has produced in the last few years a set of urban controversies. Played out in both offline and online spaces, these debates emphasized the (over) use of public space as a central topic.

4. Methodology

Mortensen et al. (2019) suggest that contentious politics and social media materialities need to be studied through three axes: space, time and platforms. Spatially, they urge scholars to consider the physical locations of protests as well as the "social media platforms and people showing solidarity from afar through digital networks" (Mortensen et al., 2019, p. 4). They also suggest that it is important to consider time, including the accelerating practices associated with social media platforms. Finally, they propose a greater focus on "how social media platforms and activist practices shape one another" (Mortensen et al., 2019, p. 5) so that a greater understanding of contentious politics operating on different (social) media platforms can be secured. Wang and Chu (2019) also address the importance of online collective action as a "space where both formal and informal organisations use social media to engage with the public" (p. 394), and highlight Twitter as a suitable platform for both spreading information through broadcast but also to allow users to find and communicate with others with the same interests and form a collective and amplified voice. The benefits of using the Twitter platform for this type of community building and connective action arise from its immediacy in terms of mobile access, 4G signals and smartphones, its ease of use (in sharing images, texts and news articles) and its search functionalities and algorithms (Plunz et al., 2019).

It is important to acknowledge that Twitter is, at best, a semi-public space, given its ownership status and selective user profiles. Founded in 2006, Twitter is a microblogging platform developed in San Francisco. Now a globally recognised platform with 330 million active users (Clement, 2020), its $30bn profit is generated through advertisements and selling data to partners through APIs or crawlers. The majority of Twitter users are aged between 18 and 49 (Clement, 2020). While there is much debate on the issue, Kozinets (2020) suggests that Twitter data can be considered as public information posted on a public site, unless the tweet has been posted by a user with a private account.

Drawing on these considerations, we utilised a mixed methodological approach to explore online (via Twitter) and offline conversations pertaining to the urban controversies over festivals and urban public space in Edinburgh. Following Kozinets' (2020) netnography framework, we spent several months immersed in the Twitter data, informed by knowledge of the sector. We observed offline and online discussions on Twitter (including individual accounts), over the period from 1 June 2019 until 31 January 2020, focused on festivals and public space. These dates were chosen to highlight significant events taking place in Edinburgh over this period which had generated debate online about the use of urban public space, with a focus on the city's East and West Princes Street Gardens (Figure 1).

Publicly accessible Tweets were gathered and organised using the commercial social media monitoring tool, Brandwatch. Initial search terms included 'Edinburgh Summer Sessions,' 'Edinburgh Christmas Markets,' and 'Edinburgh Hogmanay,' though towards the end of our data collection period the hashtag #CityforSale became significant and was included in our data set. We triangulated the Twitter data with mainstream news articles to better understand the actions or events that had triggered conversations online. Kozinets (2020) suggests the importance of seeking "lead users or lead situations," explaining that these are "users, whose present strong needs will become general" (p. 289). We checked the Twitter data for the inclusion of lead users—key social media influencers based on the frequency of their contributions, number of followers and impact of their tweets in terms of being shared with others. Finally, we also collected relevant local and national newspaper articles as these were often shared on Twitter to trigger reactions and start a conversation.

All tweets gathered around the search terms discussed (English language only, geolocation set to Scotland only) were saved into a search on the

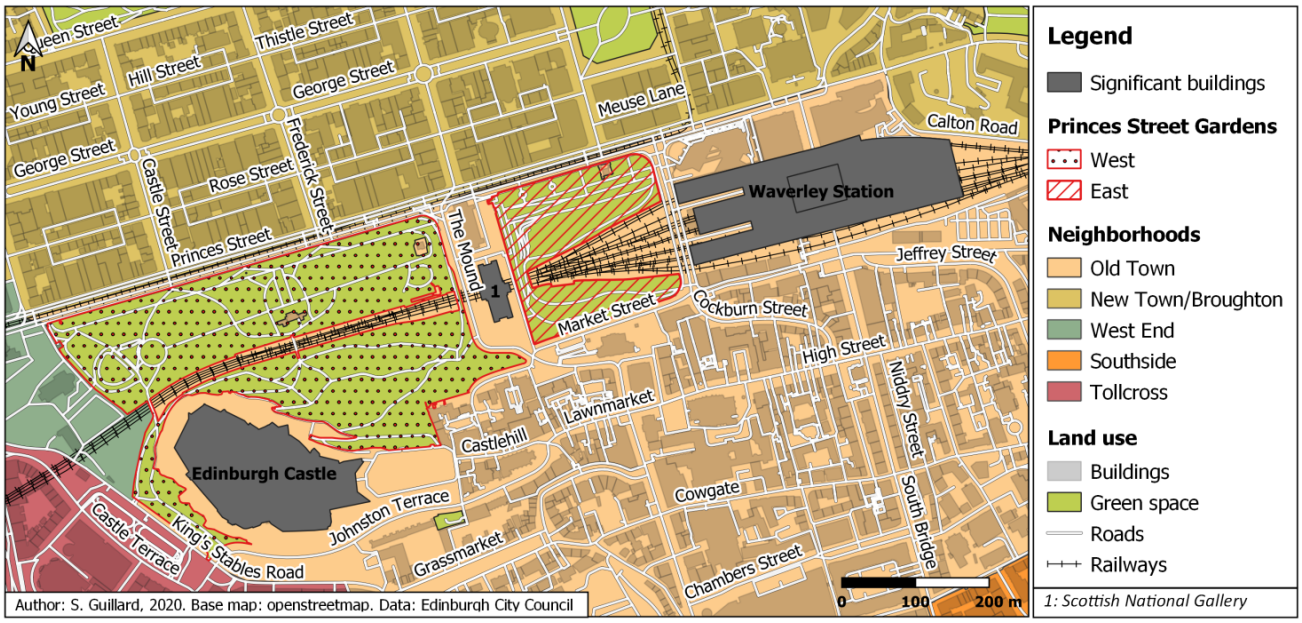

Figure 1. Map of Princes Street Gardens and surrounding areas. Source: Severin Guillard.

Brandwatch Platform. Our initial data collection gathered several thousand tweets. Further cleansing of the data was carried out using the functionalities of the Brandwatch platform to identify key themes and events, and to remove spam tweets or those posted by bots. Key themes and events were identified from the Twitter data and transferred into a CSV (excel) sheet to identify patterns of behaviour, numbers of retweets and conversations taking place around significant posts. We individually consulted the CSV Twitter data and returned to the original Twitter posts to gain more context around the posts where needed, collectively building the themes discussed in the next section of this article.

Although social media posts belong to the author of the post, the EU's General Data Protection Regulation confirm that if they are posted on social media platforms they can be used as publicly available data (DMA, 2019) to provide context or insight. In keeping with ethos of the General Data Protection Regulation, we chose to include example Twitter posts, being careful to ensure that individuals could not be easily identified. We removed Twitter handles to anonymise tweets from individual accounts (see also DMA, 2019; Duffy, Reid, & Finch, 2020; Kozinets, 2020) to afford users a reasonable expectation of privacy. However, those users who were already public figures in their own right were not anonymised, as they often represent larger civil or commercial organisations relevant to the narratives of this case (e.g., local government officials).

To enhance the quality of data produced, Kozinets (2020) suggests that netnographic studies can be complemented by other data collection methods such as interviews and secondary news sources, to help researchers fully immerse themselves in the data, allow them to seek clarification and to understand the motivations and behaviours around participants' digital activities. We carried out semi-structured interviews with three key informants involved in initiating and mobilising debate on the use of public space for festivals and events in Edinburgh. These informants were the Chair of a long-standing and influential civic heritage organisation, the editor of a prominent hyperlocal media outlet operating in the city centre, and a former City of Edinburgh Council (CEC) employee who had experience in developing policy for the use and management of public space in the city.

Finally, while not residents of the city, we spent time there attending events and public meetings over the course of the study period and one author participated in the #CityforSale event on invitation, given his work in the area over a number of years. In investigating a case of contentious politics, it is crucial that researchers immerse themselves in the research site, including observing the digital expressions of debate found online. In the following sections, we identify and discuss three key phases of the urban controversies, organised chronologically around events hosted in public spaces in Edinburgh in mid-late 2019 and early 2020.

5. Controversy #1: Summer Sessions

East and West Princes Street Gardens, the site of much of the festival and event activity discussed in this article, represent iconic public spaces at the foot of Edinburgh Castle, an internationally renowned World Heritage Site and attraction. The CEC describes West Princes Street Gardens as: "One of the most cherished public green spaces in Scotland…by locals and visitors…one of the most beautiful and celebrated city-centre green spaces, offering a backdrop unparalleled anywhere in the world" (West Princes Street Garden Project, 2020).

Questions over who can and should be able to use these spaces for festival activity have come to the fore in

Edinburgh in recent years, culminating in urban controversies materialising in the summer of 2019 and building until the early part of 2020. In June 2019, during a consultation on the redevelopment of the Ross Bandstand in West Princes Street Gardens, local conflict emerged over the appropriate classification of a major event, and confusion around the number and size of events that should be hosted there. One of Edinburgh's oldest civic heritage organisations challenged the development plans, with their Chair stating that while the bandstand was originally built to provide entertainment, "what has been notably stepped up in recent years…is the scale and frequency of events in the gardens" (personal communication).

Local concerns intensified with plans by Scottish music promoters, DF Concerts, to host their Summer Sessions music concerts over 11 days in August 2019, closing off a large area of West Princes Street Gardens around the Ross Bandstand to public access before, during and after the concerts. At this point civic heritage organisations, local community councils and (hyper) local media outlets became more vocal through traditional and social media to raise awareness about what they saw as leading the privatisation of public space in the city. An article in The Scotsman (a national newspaper in Scotland, based in Edinburgh) sparked Twitter activity that would continue throughout the summer and into the winter period. In the article titled "We Risk Losing Edinburgh's Princes Street Gardens as We Know Them Forever," the Chair of The Cockburn Association is quoted as saying that "Princes Street Gardens should be just that—gardens. We worry that the provision of a major 'world-leading' venue for gigs will see a creep to staging more large events" (Hague, 2019).

The Cockburn Association had been actively campaigning against the over-commercialisation of Edinburgh's civic heritage for years but their visibility increased with this foray into the media, accompanied by a growing following on their social media platforms (8,706 followers at the time of writing). In August 2019, another Scotsman article included comments from the promoter of the Summer Sessions concerts, Geoff Ellis, who expressed his concerns around attempts to block pop and rock concerts at the Ross bandstand in Edinburgh. Ellis suggested that "The Gardens are for everyone to enjoy, including music fans. To deny such joys is both selfish and elitist" (Ellis, 2019). However, despite this intervention, the issue of public space being compromised, or eroded, continued to gain traction, especially on Twitter. These concerns included that public parks could be closed to the public (including pavements), and the use of public space to host commercial events, as noted in these tweets:

> I do want the Ross Bandstand kept for concerts. I don't want the Gardens stopped from being public parks. I don't want the pavement on Princes St blocked off to many users. (Cook, 2019)

> Manifesto: Stop commercial exploitation of heritage sites & green space. Demand quality, curated events sympathetic to venues & sustainable. Reign in parasitic Fringe and Xmas race to the bottom. Make companies pay #Edinburgh is living not #FestivalCity #CityCentreTransformation. (TesoDB, 2019)

The urban controversy accelerated further during the Summer Sessions concert programme itself with more Twitter activity and media articles commenting on the introduction of barriers within the West Princes Street Gardens, closing of public pathways, the erection of large sound curtains, and limited pavement access. From June to September 2019, 166 tweets alone mentioned either the curtains or barriers in West Princes Street Gardens, highlighting how this issue had translated into a personalised form of political expression. Twitter users shared images of the barriers, curtains and signage put in place to restrict access to the public. One tweet (Figure 2) showing an image of benches being closed off by fences leading to a narrower pathway was especially popular, retweeted 185 times with 66 comments. Local residents posted images of signage indicating no access to Princes Street Gardens, with one user arguing that this is "the nearest green space to my home, not a commercial venue" (retweeted 14 times, 16 August 2019; Harte, 2019a).

The Summer Sessions events and their fallout, played out on both mainstream and social media, fostering a growing sense that the local state was prioritising revenue generation over protecting citizen's access to civic public space. As the Chair of the established civic heritage organisation suggested:

> Summer Sessions was probably a tipping point in it all because it was much more intrusive most notably physically by the screening along Princes Street….I think that together with other events it suggested that we were moving from a situation of a garden with an occasional event in, to an event space set in a garden. (Personal communication)

The sense that CEC was prioritising the exploitation of public space for revenue generation over its value for recreation, relaxation and recuperation was reinforced with the second major controversy—the installation of major event infrastructure in East Princes Street Gardens in November 2019 to host the annual Edinburgh Winter Festival and Markets.

6. Controversy #2: Underbelly and the Winter Festivals and Markets

Since 2013, Underbelly, a commercial live event organisation, has been contracted by CEC to produce Edinburgh Christmas Markets (attracting over 2.6 million visitors in 2019) and Edinburgh Hogmanay (attracting 160,000 visitors). The Edinburgh Christmas Markets are held in East

Figure 2. Barriers and curtains overlooking West Princes Street Gardens. Source: Wilson (2019).

Princes Street Gardens, opening mid-November through to early January. Concerns about the damage caused by infrastructure built to host the Christmas Markets had been expressed online for the last two years, with Twitter users apportioning blame to Underbelly and CEC for damage to the ground conditions in East Princes Street Gardens and its trees and saplings. However, while these concerns were generating some traction on social media, it was the revelation that Underbelly had not secured planning permission for the built infrastructure required for the 2019 Edinburgh Christmas Markets that produced a veritable explosion of print media and social media activity which reignited debate about the prioritisation of revenue generation over the foregrounding of local democratic processes, including planning.

Along with several civic heritage organisations, the Citizen Network, old town and new town community councils and local (hyper) media outlets used social media to draw attention to the fact that the CEC was riding roughshod over normal democratic processes and prioritising the interests of commerce in its relationship with Underbelly. For example, a local activist shared images of the Christmas Markets being set up in October 2019, despite a lack of planning permission, garnering 86 retweets and 96 likes (Figure 3).

Subsequently, the cyber commentary (Molnar, 2014) about Edinburgh on Twitter described it as being similar to Blackpool or Disneyworld, with the Christmas Markets commercialised rather than offering an experience reflective of the city's local culture and people. The online conversations were becoming increasingly politicised, as individual and group accounts began to coalesce around the notion that Edinburgh was selling out to commercial interests, in particular the demands of global tourism. The controversy over the Edinburgh Christmas Markets continued through November and into December 2019, incorporating the arrangements in place for Edinburgh's world-famous Hogmanay street party and celebrations which also started to generate greater critical scrutiny, especially on social media. Like the Christmas Markets, this event was promoted by Underbelly, as part of their contract with CEC. On Twitter, several images appeared showing areas of Princes Street Gardens blocked off for the Hogmanay celebrations, despite the events not taking place for a further two weeks. Figure 4 illustrates, showing a tweet from 15 December 2019, retweeted 91 times and with 167 likes.

Demonstrating how the debate extended beyond organised social groups, advocacy organisations and narrow political motives, one particularly significant thread on Twitter, started by a concerned member of the public consisted of 12 tweets posted on 22 December 2019, a week before the Hogmanay events were due to begin. The thread highlighted restrictions placed on local residents by Underbelly. Key tweets from the thread included: "This Hogmanay, Underbelly are making Edinburgh residents apply for permission to access their own homes. All residents will have to pass a police check before Underbelly decide to grant them permission to access their property" (Duncan, 2019; the opening tweet from the thread, retweeted 1,300 times, 1,200 likes and 229 comments, 22 December 2019).

Figure 3. Building the Edinburgh Christmas Markets. Source: Holledge (2019).

Figure 4. Closed Gardens for Hogmanay. Source: Harte (2019b).

The author of the thread also included a response from the promoters:

> RESPONSE FROM UNDERBELLY: "Access to homes is maintained at all times with no cost to businesses or residents, but security is ensured by the pass system." So, we should be grateful that residents don't have to pay to access their own homes? Is that it? (Duncan, 2019; retweeted 46 times and 315 likes, 22 December 2019)

The furore around the Edinburgh Christmas Markets and Hogmanay accelerated the volume and intensity of online activity, drawing in both local media and national media outlets at the end of 2019 and into early 2020. These outlets were full of stories about the negative impact of festivals and events hosted in the city's prime public space(s). Illustrating connective action in operation, much of the Twitter activity identified or tagged emerged from individuals' private accounts, albeit complemented by the tactical contributions of key advocacy and civil society organisations with a stake in the debate. Critical mainstream media coverage, locally and nationally, further emphasised the growing sense that Edinburgh had reached a tipping point in its prioritisation of (commercial) festivals and events held in valuable, and valued, public space:

> Hogmanay fury as Edinburgh residents told to apply for access to their own homes (Brooks, 2019);
>
> Petition demands resignation of Edinburgh council leader Adam McVey over Disneyfication of Capital (Matchett, 2019);
>
> The hijacking of Edinburgh's Hogmanay (Heathcote, 2020);
>
> Edinburgh City Council warned to stop chasing new tourists (Learmouth, 2020);
>
> How Edinburgh has been bought and sold for Hogmanay gold (Small, 2020);
>
> Edinburgh is selling its soul by greedily chasing tourists (Goring, 2020).

While the generation of online noise is an accepted feature of social media campaigning (Mortensen et al., 2019), there is evidence that the combination of old and new media activity produced material effects offline, with local political actors, including the CEC leadership, forced to respond and account for the failure of normal deliberative democratic processes. The business sector also felt the need to respond to criticism and promote the value of festivals and events for the city's economy. An article in the Scotsman in November 2019, "City centre chief accuses Edinburgh's Christmas market critics of jumping on a bandwagon" (Ferguson, 2019) sought to shift the narrative and project a more positive argument about the value of these events to the city. However, this intervention did little to quell the growing malcontent, which materialised in the third phase of this urban controversy.

7. Controversy #3: The City for Sale

January 2020 represented the height of online and offline agitation about the impact of festivals and events on public space in Edinburgh, with increasing levels of engagement from the wider public compared to messages posted in around the Summer Sessions controversy. For example, an image of the damaged green space in East Princes Street Gardens, shared on January 13 2020, produced 452 retweets, 879 likes and over 50 comments. The comments mostly expressed shock and anger at the mess of the public space and the role of the Council and the promoters in allowing it to happen (Figure 5).

A petition demanding that Councillor Adam McVey, Leader of CEC, be removed from his post received over 2,400 signatures. The extent of online criticism coming the way of the Council led to a public response on Twitter from McVey, where he acknowledged the existence of "strong feelings" and the fact that "we have to listen to all residents and respond to meet the challenge," mentioning that the controversy is part of "a wider debate about how we manage size & scale of festivals and tourism" (McVey, 2019). He also confirmed that a citywide conversation was about to be launched "to help shape future events" and that "we'll publish details shortly of how we'll engage with City to look afresh & decide collectively what's best for our City, our residents & our economy" (McVey, 2019).

While the intervention by the CEC sought to quieten concerned citizens, it did little to shift the public mood in the city. Testing that mood, The Cockburn Association decided to host a public meeting titled *City for Sale? The Commodification of Edinburgh's Public Spaces* on 29 January 2020. With 850 attendees and 629 tweets posted to the hashtag #Cityforsale by 139 unique authors, this offline/online event demonstrated the importance of the issue to the city's residents. Examples of highly amplified tweets included:

> Apparently, there's twice as many people at #Cityforsale than have replied to Edinburgh CC tourism consultation. People in Edinburgh want to be heard, lengthy online consultations clearly aren't working. Adam McVey please try harder. (Heald, 2020; retweeted 34 times and 98 likes, 22 January 2020)
>
> Large turnout for the Cockburn #Cityforsale public summit. Residents' concerns are clear: commodification of our public space has gone too far and must be reviewed (Edinburgh World Heritage, 2020; retweeted 24 times and 70 likes, 22 January 2020)

Figure 5. Aftermath of Christmas Markets. Source: Grouse Beater (2020).

The size and scale of the public's response to the urban controversies preceding the #Cityforsale meeting reflected the momentum that had been generated, amplified by Twitter activity, since the middle of 2019. It also reflected the importance of both offline and online politics in mobilising support for contested political issues. In the final section of this article we return to debates about public space, festivalisation and digitalisation.

8. Behind the (Virtual) Scene: The Mutual Influence of Offline and Online Politics

The Edinburgh case described here reflects the presence of complex entanglements between mainstream media, local media, social media and offline politics. In this case, the interaction and intersection between the physical and the virtual were evident, with Twitter providing the platform for individuals and organisations to share striking visual images that powerfully illustrated concerns about the potential erosion of public space in Edinburgh. Schäfer (2015, p. 326) argues that in using social media, participants often:

> Meander off topic, use unpleasant or abusive wording and ad hominem attacks, make claims not backed up by arguments or abstain from rational argumentation altogether, and use their social position in the given platform to delegitimize opposing views, or drive away opponents.

In the three controversies described here, there was certainly evidence of Twitter users using colourful language, direct attacks on local government officials and selective visual imagery to illustrate entrenched perspectives. However, it was also clear that Twitter represented a space where networks were established or strengthened, events and activities were structured and discontent was communicated, personally and institutionally.

That is how connective action frames operate (Bennett & Segerberg, 2012). They are rarely unidirectional, involving one leader with a singular vision or objective. Instead, these frames are complex, unpredictable, and nuanced, producing temporary coalitions and affiliations that can hold opponents to account.

It was also evident that the urban controversies played out on Twitter and other platforms were partly a response to perceived democratic deficits in the decision-making processes for public space management in Edinburgh. Exploiting the powerful viral potential of connective action, temporary affiliations came together to raise awareness of problematic practices impacting on the current and future plans for the city's precious public space assets. If the public sphere were operating successfully, then deliberative processes would have enabled residents, civic heritage groups and other interested parties to participate in rational debate about the desired shape of public space, and of the role of festivals and events in the city. However, it was the very failure of that deliberative process, including concerns over relationships between private event operators and public bodies that initiated the desire to make visible and share information to connect a wider public to changes taking place in the city. As Jenkins, Ford, and Green (2013) famously suggested, newer media platforms enable the creation, sharing, reusing, and adaptation of content, generating spreadable media which can be difficult to control. Visual and textual content relating to the urban controversies in Edinburgh was spread over several months, generating the fervour that led to 850 people attending the public meeting. As the established civic heritage organisation suggested:

> How we got so many people there was thanks largely to Underbelly. I don't think we could have done it without them, the Christmas market saga developed the way it did…we hit social media and it kinda took off and very quickly the tv had picked this up. I did stuff on BBC Reporting Scotland and the whole thing just mushroomed but mainly, I think, because of social media…each week that went by there was almost some new outrage. As the Christmas tree was sawn down, as the memorial benches were burnt, as the crib on the Royal Mile was removed, as the mud heaps appeared afterwards, you know, all of these things were like the fermenting agent that translated in the end to this ground swell of public concern. (Personal communication)

Building on Bennett and Segerberg's (2012) work, connective action frames need to be accessible and individualised, eliminating barriers to entry and reducing costs, for both individuals and organisations. Crucially, established organisations are still important but they need to avoid strong agendas and political brands so as not to deter individuals from participating. In the Edinburgh case, a range of civic heritage organisations coalesced with The Cockburn Association to raise awareness of the potential erosion of public space and the role of festivals and events in accelerating those processes. The Cockburn and its affiliates would have been less successful at animating the wider public had they not already secured credibility for carrying out their public space watchdog role for many years. Moreover, with a presence on Twitter since 2009, the organisation already had in excess of 6,000 followers before the start of the controversy. This prior online and offline presence was important in creating engagement from concerned citizens. Long standing credibility in the locale also contributed to media amplification of the campaign about Edinburgh's public spaces. Hyperlocal media organisations, in particular, played a significant role early on in amplifying the core message, further emphasising the logic of connective action and the importance of the hybrid model, where established voices align with personal interests via online platforms to form loose but powerful affiliations (Pond & Lewis, 2019). As our hyperlocal media respondent suggested, mutual interest guided the involvement of multiple stakeholders in the campaign to protect public space in Edinburgh, though "we are not in any formalized, concerted plan of action" (personal communication).

Exploiting its distributed dynamic of exchange and more horizontal relationship between users (Pond & Lewis, 2019), Twitter was an important platform in creating loose bridges between otherwise differentiated individuals and organisations. This case illustrates one of the strengths of connective action, whose "logic does not require strong organizational control or the symbolic construction of a united 'we"' (Bennett & Segerberg, 2012, p. 748), as taking public action on social networks is seen first and foremost as an act of personal expression and recognition. Through the medium of Twitter in particular, various groups were able to cooperate in a complementary way without compromising their individual identities. While the presence of local advocacy organisations lent credibility to the cause, the local media was able to bring editorial independence and a direct channel to local residents, and creative storytellers like the Citizen Network (tagline, Reclaiming the City) produced powerful short films which reached out to bigger audiences to raise awareness of the need for change. This creative storytelling approach concurs with Gauntlett's (2011) view that social media users can adapt platforms for their own purposes, using them as spaces for creation, discussion and debate.

The Edinburgh case is an exemplar of how offline and online logics can merge and nourish each other. The City for Sale event was, ostensibly, an example of traditional offline collective action. However, in effect the Edinburgh Central Hall represented a hybrid space (de Souza e Silva, 2006) where the online debates were shared physically and virtually simultaneously. Its rootedness in a physical setting, with a large audience, strengthened the credibility of the online discussions—discussions that until then

had been dismissed as online noise. Perhaps even more importantly, the urban controversies about public space described here illustrate that digitalisation processes can help protect and celebrate the value of public spaces. In Edinburgh, the visual documentation and sharing of images of barriers, fences, walls or curtains restricting access to public space reached an audience of interested and concerned citizens, often affected personally by the change to everyday lives. Exploiting the benefits of shareable media, this powerful imagery forced the local state and its commercial partners to respond and adapt its own practices of civic engagement to ensure a broader range of voices were heard in future public space design processes. Though played out on social media, a semi-public space, the Edinburgh controversies highlight the power of everyday creativity as a constituent element of connective action. It also shows that individuals and organisations are more than capable of understanding how to use digital media platforms successfully for political and social gain (Gordon & de Souza e Silva, 2011).

9. Conclusion

At the outset, we posed a question about the relationship between online and offline politics in the context of hosting festivals and events in urban public space, and their effects. While it remains too early to assess the long-term impact of these urban controversies on the shape of Edinburgh's urban public spaces and the activities which take place within them, it is clear that a fertile online and offline public exists. When the political is personalised and people are able to align with an action frame, policy makers can be held to account and forced to adapt their practices in response to the demands of their citizens. In this article we have demonstrated that the digital sphere can play an important role in informing and influencing the production and regulation of urban public space. While previous analyses have shown how governments try to use digital platforms to encourage civic engagement from local residents, the Edinburgh case illustrates how other forms of digitalisation also allow citizens to bypass official institutions and contribute to debates about the future of public space. Weaknesses in digital forms of deliberation, especially the ubiquity of online consultations, creates a space for alternative practices that enable disaffected citizens to influence decision making over their urban environs. While connective action using social media leaves open questions of power, privacy and equity of access, this study shows that when established organisations capture the public mood both online and offline then meaningful social action can be initiated and sustained, at least in the short term.

In the specific case of debates about the festivalisation of public space in Edinburgh, we have shown how residents and concerned groups felt the need to move online to express dissatisfaction with how these spaces were being managed, programmed and regulated by the local state. For increased awareness and attention of injustices to be translated into sustained and effective political action, traditional organisational actors had to ensure that their strong agendas allowed personal options in how people participated and expressed themselves. The Edinburgh case shows that concerned citizens, sharing and personalising their content with their own networks heightened the effects of their action. Powerful user generated images can generate attention that, when amplified by local and national media outlets, and offline political activities, can produce change. While connective action is often subject to criticism for requiring less commitment from its participants, we suggest that if mobilised effectively, social platforms represent a powerful means of strengthening local democracy in the offline space.

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Conflict of Interests

The authors declare no conflict of interests.

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About the Authors

David McGillivray holds a Chair in Event and Digital Cultures at University of the West of Scotland. His research interests focus on two main areas. First, a critical reading of the contemporary significance of events and festivals as mechanisms for the achievement of wider economic, social and cultural externalities. Second, he focuses on the affordances of digital culture, especially related to understandings of digital citizenship, participation and the role of everyday digital media platforms and practices.

Severin Guillard is a Researcher in Geography and Urban Studies. His research interests focus on cultural practices and power relations in cities, and he explores these issues through various topics (rap music, cultural policies, events, and tourism) and countries (France, United States, United Kingdom). He is currently a Postdoctoral Research Fellow at the University of the West of Scotland on the Festspace HERA project (Festivals, Events and Inclusive Public Space in Europe).

Emma Reid is a Lecturer in Marketing at the University of the West of Scotland where she teaches on the undergraduate and postgraduate marketing programmes. Emma's areas of research focus around a broad range of marketing topics and she has published in the areas of digitalisation, netnography and market studies. Prior to working in academia, Emma worked for a range of industries including social listening agencies, marketing and the construction sector.

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Article

Platform Urbanism: Technocapitalist Production of Private and Public Spaces

Sybille Bauriedl [1,*] and Anke Strüver [2]

[1] Department of Geography, Europe-University Flensburg, 24943 Flensburg, Germany;
E-Mail: sybille.bauriedl@uni-flensburg.de
[2] Department of Geography and Regional Science, University of Graz, 8010 Graz, Austria; E-Mail: anke.struever@uni-graz.at

* Corresponding author

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Abstract
Digital technologies and services are increasingly used to meet a wide range of urban challenges. These developments bear the risk that the urban digital transformation will exacerbate already existing socio-spatial inequalities. Graham's assumption from nearly 20 years ago (2002)—that European cities are characterised by various forms of socio-spatial segregation, which will not be overcome by digital infrastructures—thus needs to be seriously acknowledged. This contribution critically scrutinizes the dominant narratives and materializations of standardised smart urbanism in Europe. We investigate how the prospects of improved efficiency, availability, accessibility and quality of life through digital technologies and networks take the demands and effects of the gendered division of labour into account. By zooming in on platform urbanism and examples related to mobility and care infrastructures, we discuss whether and to what extent digital technologies and services address the everyday needs of all people and in the same way or whether there are exclusionary lines. Our objective is to bring digital and feminist geographies into dialogue, to stress the mutual construction of society and space by platform economies and to ask how gendered geographies in cities are produced through and by digitalisation.

Keywords
care; digital divide; digital technologies; gender; mobility; platform urbanism; public–private; smart city; socio-spatial

Issue
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1. Introduction

The increasing platformisation of everyday life has recently become a subject of research among social sciences. Sociologists use the term "platform society" (van Dijck, Poell, & De Waal, 2018) to describe a society characterized by the use of platforms through which information, goods and services are exchanged and in which platforms influence private and public life via data flows and algorithms. With the platformisation of more and more life spheres, the public's interest in ensuring both the accessibility of information and services and the democratic control of data have taken on a new significance as private corporations, governments and civil society compete for control over these interests. Critical urban studies use the concept of 'platform urbanism' to examine the significance of these changed everyday practices and power shifts brought about by the expansion of platform operators into all areas of urban life (Barns, 2019, 2020; Graham, 2020; Richardson, 2020). In this article we take the everyday as point of departure to look at how platforms connect services and consumers: How gendered norms in urban everyday life are re-produced by the platformisation of services, especially by mobility and care-work platforms. These two sectors appear to be particularly well suited for our argument, since platform-mediated services in these sectors have recently gained importance and are designed by international platform

companies. In general, cities are expected to bring forward sustainable solutions to tackle both the care crisis and the mobility crisis through the digitisation of services. For analytical reasons, we find it particularly interesting to put the platform dynamics of these two sectors in relation to each other, since they serve supply needs in both public space (urban mobility) and private space (home care), and thus achieve different visibilities and modes of regulation.

To date, there exist ample research on the dynamics of platform urbanism in North American cities (Elwood, 2020; Leszczynski, 2020). Research on both mobility platforms and care platforms has tended to focus on the North American urban context, although the latter also includes Asian, Australian and African cities (Flanagan, 2019; Hunt & Machingura, 2016; Kong & Woods, 2018; Strauss & Xu, 2018). By contrast, European cities are underrepresented in studies on platform urbanism, even if we know that "digitality is deeply implicated in socialspatial processes of exclusion" (Elwood, 2020, p. 1) and European cities show specific socialspatial processes and a specific demand for platform services due to their urban landscape, population structure, mobility culture and gendered division of labour. With this contribution, we will stress the regionally specific dynamics of platform urbanism.

Pairing the perspective on platformisation with smart city discourses and integrating them into a discussion of social aspects of platform urbanism, we ask how 'smartness' and the production of normative knowledge through datafication, platformisation and algorithms shape urban everyday life. We rely on approaches rooted in feminist digital geography, as they open up a view of diverse scales of urbanization, relate everyday practices to public and private spaces, and examine the production of socio-spatial difference and inequalities. We consider it essential to address how urban platforms produce embodiments, subjectivities, normative frames of social and spatial interactions, and gender norms to understand the social implications and variations of digital divides.

In general, feminist digital geographies are concerned with both epistemological and ontological approaches to datafied bodies, subjectivities and spaces in everyday life. They extend feminist critiques of 'objective science,' for example those that address how digital algorithms manifest socio-spatial inequalities. Scholars who address "digital practices as social praxis" (Elwood & Leszczynski, 2018, p. 630) have looked specifically at how digital technologies transform or re-produce gender relations (for example, the gendered division of labour in general and digitally mediated work in particular). In this context, Richardson (2018) put forward a feminist perspective on digital technologies and their impact on the geographies of work, relying on established feminist approaches to emotional labour, embodied work, and care-work at home—that is, an approach that viewed social reproduction and its socio-spatio-temporal relations as comparable to paid work outside the home.

With respect to smart cities, feminist digital geographies have criticized the framing of social urban problems as ones that can be solved through technological solutions—for example by setting up sensor technologies that regulate traffic instead of biking and walking lanes (see Elwood, 2020; Elwood & Leszczynski, 2018). However, intersectional analyses of the digitally mediated aspects of urban everyday life—that is, studies that explore how digital technologies are enmeshed with gendered, classed, racialised socio-spatial relations and how digital practices shape socio-spatial everyday praxes of different bodies and subjectivities—are still scarce. Following the observation that "most urgently, the 'digital' requires attention to the space and time of everyday life in order to attend to the ways the co-production of space, people, and the digital coalesce" (Gieseking, 2019, p. 87), this article draws on two of the main themes of feminist digital geographies as springboards to discuss everyday platform urbanism and gendered digital divides. These themes—work/caring and mobility/sharing—both refer to and depend on everyday activities. Moreover, both have been established within pre-digital feminist geographies against the background of the gendered division of labour and the spatialisation of gendered labour. The spatialisation of this division illustrates the mutual construction of society and space (Massey, 1994, 2005) and of gender and home, respectively: The division of labour both affects and is itself an effect of the spatial separation of 'male' productive work in public spaces and 'female' reproduction work at home/private spaces (Brickell, 2012). Moreover, as Massey argued more than two decades ago, "spaces and places are not only themselves gendered, but in their being so, they both reflect and affect the ways in which gender is constructed and understood" (Massey, 1994, p. 179). The mutual construction of society and space needs new attention in connection with digitalised everyday life in urban societies and spaces, but we especially lack critical investigations of platform capitalism in smart cities. Attoh, Wells, and Cullen (2019), for example, discuss labour with reference to the production of data for exploitation by intermediating platforms, such as Google. Only in a second step do they refer to the everyday life of the workers and consumers who produce this data via platforms. Relying on recent literature, this article addresses the latter group, focusing especially on care workers who use peer-to-peer platforms and on car sharing offered via business-to-consumer platforms, relying on recent literature.

The starting point of this contribution is a critical scrutiny of the dominant smart city narratives with respect to their promises for sustainable urban development and the contradictions those promises bring forth. Following this, we discuss the concrete consequences of digitisation for the socio-technical relationships between citizens, cities, and urban infrastructures with reference

to platform urbanism. By exploring two central sectors of urban everyday life—care-work and mobility—we illustrate how platform economies and platform practices increasingly standardise the demand for these services, (de)privilege urban spaces, and manifest the gendered division of labour. In large European cities, demand in these sectors is increasingly organised through platforms, and the same platform companies are active in most major European cities (e.g., ShareNow in the mobility sector, care.com in the care sector). Against this background, we investigate whether and to what extent digital technologies and services address and treat all people equally, or whether there are socio-spatial regimes at work that include and exclude certain categories of individuals along gender lines (and their intersections with class and race). In our conclusion, we take a systematic look at the explicit role of and production of space in interconnection with the socio-technological changes that sectoral platforms bring about, and also seek to bring digital feminist geography into a dialogue with critical urban studies.

2. Smart City Narratives

This is the vision of the European Commission's programme for a European innovation partnership on smart cities and communities:

> A smart city is a place where traditional networks and services are made more efficient with the use of digital and telecommunication technologies for the benefit of its inhabitants and business. A smart city goes beyond the use of information and communication technologies for better resource use and less emissions. It means smarter urban transport networks…a more interactive and responsive city administration, safer public spaces and meeting the needs of an ageing population. (European Commission, 2020)

Smart city narratives like that represented in the above citation always aim to tell a story of innovation or progress. They have a strong reference to 'sustainability' and a vision of a world in which people, the economy and the environment can happily and lovingly interact in mutually supportive, cohesive, and historically reproducible ways, mediated by increasingly 'smart' technologies (Swyngedouw & Kaika, 2014; Wiig, 2016)—even if the corresponding visions of progress differ fundamentally from the principles of a pollution-free, healthy city or a social housing policy.

Idealization of the 'smart city' is based on the view that such cities improve the quality of life for all by increasing the flexibility, diversity, and accessibility of nearly all local services, such as those related to mobility and energy supply, online shopping, urban navigation, environmental monitoring, public wifi, e-governance. These promises are always connected to a universalized idea of independence and freedom, with scant attention paid to the fact that these promises and ideals are not equally valid and attainable for all people. The aims associated with flexible services, and the need for them, have different meanings and relevance for different social groups, in accordance with the gender, class, race, sexual identities, age and body ability of each. Promises, images and visualizations of smart city technologies reinforce rather than disrupt traditional gendered associations and replicate existing network capital inequalities (Wigley & Rose, 2020).

However, gender normativity is not produced by technology as such, but by the digital services of information and communication technology companies. Digitalised urban infrastructures and supply services do not automatically meet all the needs and accessibility options of all individuals. Digital divides emerge between generations with different levels of digital literacy and between persons in different income groups, some of whom cannot afford Internet-enabled smartphones and digitalised services or lack the requisite credit cards, residency status, or other formal requirements.

'Smart city' is thus not a single narrative, but rather builds on polyphonic and contested narratives with correspondingly different imaginary representations for present and future cities (see Bauriedl & Strüver, 2018). Recent years have witnessed the rapid rise of extensive debates within critical urban studies on digital urban transformation on the subjects of smart cities, smart urbanism, and platform urbanism, defining and differentiating these concepts in different ways (Lee, Mackenzie, Smith, & Box, 2020). In this article, we consider 'smart city' solely as discourse and programmatic urban policy, since there are no explicit criteria for smart cities (Bauriedl & Strüver, 2018). In analysing the resultant forms of urban praxis, we understand the digital transformation of urban everyday life as a form of smart urbanism. In the next section, we address platform urbanism as a specific practice of smart urbanism, one characterized by platform economies and the manifold use of intermediate platforms. Promoting a debate that deconstructs this universal smart city storytelling requires, first of all, our sensitivity to the "diverse histories, cultures and political economies and variegated forms of capitalism that shape patterns of urban and economic development and the relationship between state, market and society" (Kitchin, 2015, p. 133). We investigate how the prospects of improved efficiency, availability, accessibility and quality of life through digital technologies and networks take into account the demands and effects of the gendered division of labour.

3. Platform Urbanism

European cities are characterised by multiple forms of spatial segregation and social polarisation, which are not automatically remedied by digital infrastructures (Gilbert, 2010; Graham, 2002). Far from being helped by digitalisation, social marginalisation is actually inten-

sified by the creation of new jobs in the urban platform economy, known as the 'gig economy,' with its precarious employment conditions (Wiig, 2016). In what follows, we discuss cities as datafied space (Kitchin, 2014) in which digital data in general, and platform economies in particular, increasingly shape and intermediate urban life.

As the evolution of platforms indicates "the socio-technical relationships between citizens and cities," we need to ask how "platforms are changing urban socio-spatial practices and services" (Lee et al., 2020, p. 116). This is increasingly addressed as 'platform pivot' and 'platform urbanism'—as the manifestation of smart city narrations, and as digitally enacted everyday urbanism as it enters and shapes socio-spatial experiences and daily urban lives, beyond the scope of city halls and public discourses (Barns, 2019).

As socio-technical ties between cities, companies and citizens, platforms are based on the relational dynamics between code, commerce and corporealities in technology-driven everyday life. They change both how cities themselves function, and how people live, work, eat, communicate and move in cities (Barns, 2019; Lee et al., 2020). Against this background, we adopt the following differentiation of smart and platform urbanism:

> Smart urbanism is primarily about optimizing oversight of city systems through state procured, corporate provided 'solutions,' whereas platform urbanism aims to transform and/or take over the operations of city services that tend to be more market- or consumer-oriented. These two models do not necessarily supersede or even compete with each other; rather, they work simultaneously in different spaces. (Sadowski, 2020, p. 2)

Because of this shift towards daily life, platform urbanism seems easier to access empirically than 'smart city' strategies and their related meta-narratives of neoliberal capitalism. However, the city is not a spatial container, and replacing platform capitalism with platform urbanism is a grossly oversimplified solution (Graham, 2020). In her feminist theoretisation of platform urbanism, Leszczynski (2020) stresses the need to go beyond urban platforms as part of neoliberal capitalism and instead to focus on the everyday, thereby exploring the emancipative potentials of urban platforms. In the same vein, Elwood (2020) emphasises the task of critical platform research in reconstructing normative digital-social-spatial relations of technocapitalist urban life. In this context, technocapitalism is understood as the capitalism that is associated with the emergence of new technology sectors, the corporative power, and new forms of organising spatial and social relations:

> Platforms benefit from the population density and spatial proximity of users/workers in cities. There are more opportunities for mediating social relations and extracting economic value in large, diverse markets. There is a pool of precarious 'freelancers' who are shuffled from gig to gig. (Sadowski, 2020, p. 3)

Urban platform economies change the consumption, perception and production of material urban space. However, this change is not only economically driven, but also practiced by citizens who shape urban structures from their smartphones. This is particularly obvious regarding (on-demand) digitally mediated service platforms, to which we will now turn.

4. Gendered Platform-Mediated Services: Sharing and Caring in Urban Daily Practices

The gendered division of labour has been criticised by feminist urban planners, social geographers, and others since the 1970s (see, e.g., Bondi, 1998; Bondi & Rose, 2003; Brickell, 2012; Massey, 1994; Meehan & Strauss, 2015). This critique encompasses the different symbolic as well as monetary values of paid work outside the home—associated with men or masculinity—and private domestic (physical and psychosocial) reproductive work, which has female connotations and is predominantly done by women. Accordingly, gender norms and stereotypes of femininity and masculinity play important roles in the division of labour, in addition to broader socio-economic structures. The critique also bears a direct reference to the urban planning model of functional separation that prevailed during the 1960s/1970s, which spatially isolated living, working, shopping and other activities from each other in order to prevent possible negative influences. In tandem with the trend towards suburbanisation since the 1960s, residential areas have been increasingly built at the margins of the city; as a result, the gendered division of labour is linked to a spatial division, marginalising care-work at home, both socially and spatially. The spatial manifestation of the gendered division of labour thus includes the idea and ideal of the home as a place for women to do care—and housework that is unpaid, often hidden or literally overlooked and invisible (Bondi, 1998; Hayden, 1983). Moreover, the gendered division of labour and its socio-spatial organisation cannot be approached through gendered identities, but only through questions of the organisation of work in capitalist structures (Parker, 2011).

In this article, we examine different service platforms of general interest to advance the debate: free floating car sharing mobility and home care. For more than a decade, services in these two sectors have been mediated between business to customer and between peers via platforms that create new opportunities to use public and private spaces differently.

4.1. Digitally Mediated Mobility Services: Car Sharing

Everyday mobility practices in cities are very diverse: transportation users may travel alone, as a family, or in

a group; they can be young or old, athletic or physically challenged, have abundant or very little money, have or lack the ability to cycle and drive, be scared or courageous. In going from one place to another, these consumers may cover short distances or long distances, and may or may not use a chain of transportation options. All these mobility conditions and needs, together with the built transport infrastructure and the available modes of transport, are crucial to each person's mobility decision. The demand for flexibility and accessibility and the costs of urban transport services result from all these very different structural conditions and individual needs.

The mobility debate is largely characterised by statements about the positive potential of technological innovations (Liyanage, Dia, Abduljabbar, & Bagloee, 2019). In recent years, the near-ubiquity of Internet in cities and the spread of mobile end-user devices has injected a new dynamism into urban mobility offers and services. In particular, an expanding range of car sharing services is now considered to be a characteristic of smart cities. In addition to the use of private vehicles and public transport, a variety of platform-mediated sharing options (car sharing, bike sharing, scooter sharing, ridehailing, ridepooling) are available. Car sharing involves the sharing of private vehicles and transport services via Internet platforms, using various forms of mediation (peer-to-peer or peer-to-pool), location ties (stationary or floating) and various types of vehicle use (self-driving, passenger or autonomous driving; Prettenthaler & Steininger, 1999). These platforms give consumers connected, real-time information to help optimise their use of private and public transport (mobility as a service).

Given that (urban) mobility is gendered and thus produces socio-spatial inequalities (Law, 1999), one issue of central relevance to future mobility infrastructures is whether new smart mobility services address all transport users, or rather prioritise already privileged groups and thus reproduce urban inequalities. In the following section, we focus on the potential of car sharing services to promote a socially just urban development (Sheller, 2012), examining whether such services can create typical route chains for caregiving activities. Traveling from one stop to another is a daily routine for unpaid caregivers (Uteng & Cresswell, 2008). These reproductive activities are still largely viewed as women's work. In order to discuss the available mobility potentials, we now take a closer look at the offers and business models put forth by car sharing platforms.

Emerging in the late 1980s in Switzerland and Germany, car sharing initially surfaced in the form of small projects created by environmentally minded groups. Internet applications have made booking procedures more efficient and user-friendly, while smart cards and later smart locks improved access to cars. Germany is clearly the regional focus of free floating car sharing within Europe in terms of the number of mobility services and the size of vehicle fleets. The market for free floating car sharing providers is currently dominated by the ShareNow-platform (a joint venture of car2go operated by Daimler and DriveNow operated by BMW). According to information provided by the companies themselves, by 15 May 2020, ShareNow had approximately 14,000 vehicles in use in eight European countries (ShareNow GmbH, 2020). Daimler started this business model in 2008 with its car2go platform, Europe's first business to customer free floating car sharing operation, which mainly served Germany's largest cities. Today's car sharing organisations can be classified into five main types of business models, based on their operational characteristics and business model variables: 1) free-floating within an operational area, 2) free-floating with pool stations, 3) round-trip and home-zone based, 4) round-trip and station-based, and 5) peer-to-peer. All platform providers repeatedly use the keywords 'increased resource efficiency' (producing and sharing fewer vehicles), 'flexibility' (permanent access to means of transport that meet demand), 'optimisation' (increased traffic flow) and 'acceleration' (information on the fastest connections).

All of the platforms provided by automotive companies follow the one-way model of mobility, which offers high flexibility in that it allows users to drop off a car anywhere within a designated city area (free-floating). By contrast, it offers limited flexibility in terms of scope, since the business areas of the mobility platform providers are limited to inner city areas and the cost structure of free floating car sharing supports one-way mobility. The business model of smart mobility platforms adapts other offers to users' movement profiles. This leads to a self-reinforcing process that works to privilege specific social groups and urban identities and creates a gendered digital gap (Alonso-Almeida, 2019, p. 38; Strüver & Bauriedl, 2020).

In many mobility studies, the description of mobility as a complex physical and social relationship is reduced to measurable figures and calculable flows of goods and people (Hanson, 2010, p. 13). The few available studies on the social composition of users of smart mobility services deliver very limited findings on the correlation of user interests and social categories. Mobility studies tend to use a quantitative approach that is based on movement data or mass surveys. Nevertheless, one trend on gender relations can be identified: In European cities men are the main users of stationary carsharing, for which average user age is higher than for free floating car sharing (Uteng & Cresswell, 2008). In German cities—where carsharing is most widespread—up to 80% of free floating car sharing users are male, well-educated and in full-time employment (Giesel & Nobis, 2016). Karen Lucas (2012, p. 107) has coined the term "transport poverty" to describe the link between social exclusion and mobility. Along the exclusion dimensions, various forms of mobility-related disadvantage (e.g., lack of information about mobility opportunities or high transport costs) overlap with aspects of social disadvantage (e.g., low income or poor health).

It is not the intention of smart mobility to be gender-smart (Singh, 2019). Current feminist mobility research focuses predominantly on the political when looking at issues such as transport system configuration, resource allocation, priority setting, and transport system user construction. They criticise the liberal paradigm for transportation planning, which assumes individual rationality and a market-oriented economy while neglecting the structural conditions of mobility behaviour and mobility preferences (cf. Scholten & Joelsson, 2019, p. 7). In cities, women travel on average fewer passenger-kilometres, but often have a higher total driving time than men, with many stops related to paid work as well as care-work and housekeeping. They often create complex chains of multi-destination routes within a smaller mobility radius.

4.2. Platform-Mediated Care-Work

While the mutual constitution of gender and space is multi-scalar, in the case of care-work it is focused on the micro-level of the household. For most people, the home is an essential part and place of everyday life, a place for regeneration and reproduction, but also where gender norms are negotiated (Beebeejaun, 2017; Bondi & Rose, 2003; Peake, 2016). The sharp increase in the proportion of women working in paid jobs outside the home has transformed the gendered division of labour and its spatial manifestations discussed above. Since the 1990s, some of the duties associated with traditional reproductive work have been outsourced to other persons/spaces (for example, by using a delivery service or eating out instead of shopping and cooking, or to digital assistants such as cleaning and care robots). The growing commodification of care-work has made this type of work more public and more visible, but not necessarily more recognized. At the same time, the privatisation of social services and healthcare reforms by neoliberal restructuring and the consequences of the global financial crisis have re-integrated some reproductive work into the home along gender norms. Reproductive services and care-work thus have been 'privatised' again—in the sense that they have returned to private homes and, for example, are being provided as unpaid, home-based care by relatives (Federici, 2019; Huws, 2019). Moreover, neoliberal restructuring particularly affects women in low-income households and with precarious jobs. Against this background, Beebeejaun (2017) has reconsidered the gendered division of labour and the gendered separation of public and private places in neoliberal cities and points out that gendered everyday life in urban contexts remains underexplored (see also Gilbert, 2010; Peake, 2016; Strauss & Xu, 2018). Yet, gender (and class and race) are organising principles of societies, and thus preceded the experiences of individual subjects. Gender continues to shape urban forms, functions and spatial structures, e.g., the separation of urban functions related to home and work—which, in turn, shape gender norms and subjectivities.

Care-work in the private sphere of the home illustrates—in addition to the neoliberal policies and politics of reproducing gender relations—the growing differences (and dependencies) between women of the professional classes and unskilled working-class women. The mounting demand for paid care-work such as childcare, eldercare and domestic services, including the commodification of routine domestic tasks such as cooking and cleaning, reflects a situation in which women working in professional occupations often depend on the care-work of other women (and sometimes men; Meehan & Strauss, 2015). In concentrating on paid care services in the home, Dyck (2005) has stressed the intersections of gender, class, race and ethnicity on the one hand, and the complicated interconnections between neoliberalism, globalization and changing age structures on the other. Low-paid care-jobs within homes soften the impact of public sector privatization and especially of cuts to welfare programmes and public childcare and health care. This is but one of many arguments that call into evidence the major significance of the spaces of everyday life in general, and the private sphere of home in particular, to research on urban platform economies. Moreover, this is a refinement of Gilbert's (2010) assertion that race, gender and technocapitalism are intertwined as inequalities in urban spaces. She stresses the need to research in depth people's daily lives and their experiences of gender, race and class as part of the relations of digital and urban inequalities that affect labour markets and vice versa.

Care-work platforms are typical examples for so-called lean platforms of the gig economy (Srnicek, 2016). Unlike mobility-platforms, they are demand-driven and set up as peer-to-peer-platforms that match care-workers and households by means of registration fees or transaction fees for the workers. Taking into consideration that the previous global commodification of care-work at the turn of the millennium was interrupted by the financial crisis in 2007/2008, such platforms have accelerated the recommodification of care-work. On the one hand, the recommodification can be seen as a result of the crisis, since formerly public care services were privatised after 2008 as part of neoliberal restructuring (Huws, 2019). On the other hand, digital platforms providing care-work also have their roots in this crisis, since setting up platforms was and is not dependent on large capital investments but rather on existing 'assets' such as cars, flats, working bodies to be 'shared' between service providers and consumers:

> This post-crash landscape has also provided the perfect conditions for new flows of (venture) capital in the form of digital platforms that want to operate core services related to how we live, how we work, how we travel, how we consume. (Sadowski, 2020, p. 2)

Growing demand for care-work at home in the pre-digital era has been summarised as "institutionalised informalisation" (Strüver, 2013, p. 198) and is now known as the

"formalisation of the informal economy" (Huws, 2019, p. 20) and as a platform-based formalisation which creates trust between strangers (Ticona & Mateescu, 2018). Care platforms like peer-to-peer-business models aggregate data from the personal profiles of care workers with data related to their responsiveness and customer evaluations. This kind of algorithmic intensification of exploitation and surveillance is in stark contrast to the attributes, such as responsibility and trust, that characterise care relationships (Flanagan, 2019; van Doorn, 2017). Moreover, as part of the gig or on-demand economy, care platforms intensify the unequal power relations between the peers and encourage workers' flexibility in terms of when, where and what they work on and the expected income they receive for that work.

Current platform-mediated care-work challenges the classification of such work as unpaid, domestic women's work and seems to redefine the relations between value, visibility and vulnerability of care workers. Yet it does not contest the invisibility of care-work, its association with the private sphere, or the vulnerability that is typically associated with flexibility. On the contrary, we would rather suggest that the persistent invisibility and 'private-ness' of care-work intensifies its devaluation and the related precarity of workers, despite being paid work. For example, although the workers who do such labour do not know each other they are in a constant competition regarding wages, speed, rating results, and the overall quality of their gigs.

In a nutshell, it could be said that the invisibility of care-work and the interdependencies of gendered, racialised and classified inequality are a prerequisite for and intensified by platforms. At the same time, "code, social media, and data now play a central role in shaping gender and racial identities, reinforcing sexist and racist stereotypes" (Gieseking, 2019, p. 86). However, both the working bodies and the re/productive work done remain hidden and unseen. Furthermore, Ticona and Mateescu (2018, p. 4400) make a case that this invisibility also includes a disappearance behind the 'uberization-narrative' regarding on-demand platforms that draw public and academic attention mainly to Airbnb, Uber and food platforms—not to the much bigger platforms such as care.com (see also Barns, 2020).

Just as in the pre-digital era, the seemingly everyday micropolitics of care-work are now, as a part of the on-demand platform economy, linked to macropolitical structures, such as neoliberal framings of labour, the gendered divisions of labour, and the feminisation, racialisation and precarity of care-work and related spatial politics (Strauss, 2019; see also Meehan & Strauss, 2015). Its contribution in technocapitalism means that platform-mediated care-work, far from disrupting gendered social and spatial relations, tends rather than to call it into evidence as its manifestation: "Housework, it turns out, is at the epicentre of capitalism. And the labour of social reproduction, which underpins it, also represents its future potential for expansion. Feminist strategies for addressing it will therefore have to take on capitalism itself" (Huws, 2019, p. 21).

5. Outlook and Research Gaps: Invisibilities and Inequalities

In bringing together feminist digital geographies with critical urban studies in order to address the mutual construction of society and space by platform economies, we have highlighted how digital practices shape socio-spatial everyday praxes of different subjectivities. In particular, we have been attentive to gender norms as they become evident again in their relation to public and private spaces that are, in turn, reproduced by the platformisation of urban everyday life. The underlying technocapitalist structure of the platform economy and the social processes that are built upon it are shaped by subjectivities such as gender, race and class and platform urbanism thus does advance unequal power relations. Digital principles of standardisation, scope/scale and speed/volume mirror the foundational logics of this recent kind of capitalism (Elwood, 2020, p. 8). The spatial public–private divide is manifested in platform urbanism and can be discussed as a form of digital divide that relies on socio-spatial inequalities and reproduces gendered subjectivities at the same time. In this outlook, we therefore stress the role of space in sociotechnological change in terms of urban mobility and care-work platforms, which as effects of technocapitalism reproduce the invisibilities and inequalities along gender, race and class.

Platforms contribute to a gendered production of space. It became clear that car sharing does not break up gendered mobility patterns, but rather reinforces inequality structures, which we call a gendered platform mobility divide. On the demand side of the free floating car sharing platforms, it can be seen that these address an exclusive group of users, most of whom are male, young with above-average incomes. The algorithm-generated services reinforce this homogeneous constellation. The need for mobility that allows frequent and longer stops along the journey is not provided with this mode of car sharing. However, route chains are a daily need of people who care for family members and for people adding several platform gigs throughout a day—and that might be more time-consuming and/or more expensive. These activities are mainly carried out by women who are dependent on other modes of mobility.

To date, the development of mobility and care platform infrastructures and services appears to be an exclusively urban phenomenon—one that, being concentrated in metropolitan centres, privileges already advantaged areas within cities. Although urban environments certainly derive benefit from the existing dense range of mobility services, the urgent infrastructural needs in rural and suburban areas are currently not being met by digitalisation and platform-mediated mobility and care services.

The current state of knowledge on the business models and modes of use of free floating car sharing plat-

forms shows (Alonso-Almeida, 2019; Uteng & Cresswell, 2008) that 1) the gendered division of labour in care-work continues through digitised mobility practices in public spaces; 2) the service structure of free floating car sharing in terms of range, charging mode and vehicle facilities is neither adapted to the needs of family care-work, nor to platform-mediated care-work; and 3) the promised flexibilisation of supply services and optimisation of urban infrastructures only apply to previously privileged population groups. We derive the following questions from these findings:

> To what extent do car sharing platforms make a contribution to socially inclusive mobility in large European cities that is optimised in terms of costs, time and traffic?
>
> Could car sharing platforms in suburban or rural areas, with low public transport coverage, cover a wider range of mobility needs, or are the supply structures in principle not geared to diverse needs?
>
> Do private, public and non-commercially operated mobility platforms differ in their usability for route chains?

While care-work at home always has been beyond the formal workplace, digital technologies have enabled various modes of work to take place at home without substantially touching the established gendered division of labour. Departing from the essentialist stance equating care-work with women's work and shifting the focus to gendered power relations includes highlighting socio-spatial inequalities, including the ongoing devaluation and invisibility of care-work on the one hand and the feminisation of poorly paid work on the other. We conclude from research on platform-mediated care-work in North America and Australia (Flanagan, 2019; Ticona & Mateescu, 2018; van Doorn, 2017) that 1) the gendered division of public and private spaces is not only manifested by care platforms but is essential for their existence and that 2) the invisibility of care-work intensifies intersectional inequalities of race, gender and class and discrimination by platforms. Especially with concentration on care-work platforms, future research in European cities needs to centre on the following questions:

> To what extent are care-work platforms *urban* phenomena relying on population density and heterogeneity, on short travel distances, anonymity etc. that change the use, perception and production of material urban space?
>
> Do care platforms produce new spatialisations of the social? Or do they manifest pre-digital spatial divides and related uncertainties, inequalities and invisibilities?
>
> As most of the research on urban care-work platforms stems from the USA and Australia: Are care platform effects the same in Europe?

Digital platforms mediate specific services for everyday life in cities, lead to new relations and interaction between service providers and users. The two examples of sectoral platforms (mobility and care) influence social relations and spatial productions in different ways. However, both generate standardisation and normalisation of everyday practices that create new socio-spatial exclusions or reinforce existing ones.

Problems of urban divides cannot be fixed by outsourcing public services to platforms. Their success models are disruption and network effects by size. This dynamic was, for example, very obvious during the 'lockdown' related to the Covid 19-pandemic: Neighbourhood platforms for the solidarity supply and sharing of goods, which had spontaneously emerged at the beginning of the pandemic, either vanished or were very quickly taken over by commercial platforms offering paid services due to network effects. Platform providers aim to grow and scale up their services to dominate the market. They are not interested in solving local and social problems.

Furthermore, platform economies take the diversity of urban population not into account, but consider their workers and their customers—and their needs—as universal. The mobility patterns and needs of care-workers, for example are not taken up by the mobility platforms as they are more oriented towards recreational use and both socially and spatially address only selected parts of the urban population. However, combining the research on mobility and care-work platforms and following Leszczynski (2020), we should intensify the search for emancipative potentials through care and mobility platforms with focus on the gendered division of labour aiming for socio-spatial justice in platform-operated cities.

As feminist and critical urban geographies are concerned with people's everyday life and socio-spatial inequalities—that is, social inequalities related to the production of space and to spatial segregation resting on social structures and identities—the present technocapitalist production of urban space needs further empirical attention, especially in European cities. Technocapitalism is increasingly part of and regulating people's daily lives—and occurs again along norms based on gender, race and class. Linking care and mobility as two prominent urban platform economies allows us to put forward research on normative digital-socio-spatial relations particularly addressing inequalities inherent in these relations.

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Conflict of Interests

The authors declare no conflict of interests.

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About the Authors

Sybille Bauriedl is Professor of Integrative Geography at the Europe-University Flensburg (Germany). She has been researching and teaching sustainable urban development and global environmental conflicts since the 1990s. She is engaged in scientific networks of political ecology and feminist geography and is involved in the right to the city movement. Current research projects deal with local energy transition, smart urbanism, colonial infrastructure in European port cities, and climate justice.

Anke Strüver is Professor of Human Geography with a focus on Urban Studies at the University of Graz (Austria) since Fall 2018. In 2004 she completed her PhD at the University of Nijmegen on the socio-cultural production of cross-border spaces and their effects on everyday practices. She became a Professor of Social Geography at the University of Hamburg in 2010. Her research focuses on embodied human-environment relations in the city, especially along the themes of health, food and active mobility, as well as focused on digitalisation and sustainable co-laboration.

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Article

The Urban Digital Platform: Instances from Milan and Amsterdam

Letizia Chiappini [1,2]

[1] Department of Geography, Urban Planning and International Development, University of Amsterdam, 1001 NC Amsterdam, The Netherlands; E-Mail: l.chiappini@uva.nl
[2] Department of Sociology and Social Research, University of Milan-Bicocca, 20126 Milan, Italy

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Abstract
The article interrogates the concept of the urban in relation to digital platforms designed for citizen-based initiatives and local projects. We must broaden our scope as urban scholars to include this vast undergrowth of 'other' platforms and study how they intersect with the social and material fabric of cities. Drawing from media and internet studies, urban sociology, and digital geography, I introduce the novel concept of 'urban digital platform' (UDP). I do so theoretically by using a digital geography body of work and the level of abstractness proposed by Bratton (2016), in 'the stack,' which are entry points to define any kind of digital platform. While global and for-profit digital platforms exploit density, size, and diversity, extracting resources into a data-driven form of governance and computational production of space. UDPs benefit from the urban as a front to (re)organise citizen-based, mutual-aid initiatives, and solidarity actions. The core of the UDP concept lies in the ambiguity of the role of the urban government, media literacy, and techno-biases as basic requirements for citizens to access the platform, its services, and goods. Those claims are supported by instances and empirical findings of two analysed platforms in Milan and Amsterdam.

Keywords
city layer; digital geography; platform urbanism; urban digital platform

Issue
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1. Introduction

Digital platforms are affecting cities in myriad ways; they impact both interurban connectivity and intraurban functionality. The existing literature on digital platforms defines them very broadly, namely as any digitally hosted instrument to share or enable the exchange of information or services at a global scale. Notions such as 'platform capitalism' (Srnicek, 2017) and the emergent concept in urban studies of 'platform urbanism' (Barns, 2019; Moore & Scott, 2018) capture one side of the urban transformation that our cities are facing. This one side mainly focuses on the increasingly central role of data, conceived of as a commodity, where digital platforms play a role as global capitalist forces in sourcing data and monetising it (Rose, Raghuram, Watson, & Wigley, 2020). In the concept of 'platform urbanism,' there is a specific urban character: Platforms that deal with the urban tend to share initiatives, information and knowledge, and be dependent on cities for their data, service, and local networks. At the same time, there is no critical eye on the differentiation between digital platforms that commodify urban resources and another subset of platforms, which digitally-mediate urban experiences, such as citizen-based solidarity initiatives, in which the local state might have a role not only as a regulator but as an active promoter.

There is still little knowledge regarding not-for-profit digital platforms which are designed for public participation, solidarity, and diverse transactions beyond those that are exclusively economic. Public participation and grassroots initiatives vary from civic crowdfunding and complementary welfare platforms (i.e., time-banks) but they also pertain to broader societal effects, such as solidarity, democratic control, and accountability. In particular, during the Covid-19 pandemic crisis, a crucial aspect has emerged. On one side, global digital platforms such as Airbnb and Uber are losing grip in cities; due to the cir-

cumstances, they are adjusting their business model to circumvent regulatory regimes and suit (again) the market (Richardson, 2019). On the other side, new types of digital platforms are gaining terrain in offering support: mutual-aid and solidarity at a city-level. For instance, the municipality of Amsterdam launched its own digital platform 'We Amsterdam' storing both offline and online civic initiatives to support citizens during the corona crisis (Mos, 2020). Elsewhere, the Milanese municipality opened another round of civic crowdfunding, offering financial support to help vulnerable citizens during the corona outbreak which severely hit Lombardy and Milan. The questions on how digital platforms affect urban geography and governance arrangements, and vice versa, as well as how cities affect digital platforms are not arbitrary within urban studies.

Urban digital platforms (UDPs) are potential ways to (re)organise the social economy, civic initiatives and complementary welfare provision. Besides, UDPs necessitate a revision of the role of the local government as they enable new forms of social organisation as well as new forms of both producing and delivering goods and services. Hence, this article reflects upon urban platforms as an alternative output form of grassroot and entrepreneurial projects, community-oriented practices and collective actions, in which the local state might intervene to prevent or favour a particular kind of urban development and production of urban space (Fisker, Chiappini, Pugalis, & Bruzzese, 2019). UDPs are an alternative form of escape from the voracious and exploitative global digital platforms. The core of my argument is that certain digital platforms are urban a priori, i.e., platforms for the city, rather than platforms which feed on it: where 'the city' is conceived as an urban commonwealth, not a growth pole. As summarised in Mark Purcell's (2008) *Recapturing Democracy* and in "Cities for People, Not for Profit," by Brenner, Marcuse, and Mayer (2009), the UDP is a platform for people and not for profit, aiming at recapturing accountability and democratic principles.

In order to lend visibility to, and direct analytical attention toward, a wider diversity of platforms, I introduce an operationalised definition of the UDP. UDPs can be an opportunity for solidarity-based 'urban commonwealth' (Kohn, 2016), reimagining the city as an "innovative form of collective cooperation and collective corporation" (Merrifield, 2014, p. 390). Citizens are not re-cast in the role of consumers but rather as producers of space. Different from smart city projects or platform urbanism in which users are able to participate in mundane tactics and everyday life activities, such as using a bike-sharing service, UDPs offer the possibility to (re)create urban commons and generate solidarity and collective actions. Those observations derive from four years of fieldwork in Milan and Amsterdam. The research is a comparative perspective based on a match-pairing of two UDPs which operate in both cities: civic crowdfunding and Commonfare. The methods deployed are mostly qualitative, such as 20 interviews, participant observations, and mapping of projects within the abovementioned UDPs.

Both platforms represent potential alternatives for local arrangements and citizen engagement, without profiting from the urban or directly exploiting local resources. The UDP term is an attempt to revitalise the importance of the urban as a space of contestation and potential political rearrangements towards alternative production of space, rather than as a space for corporate-led digital platforms. The need for the UDP as a new concept is to broaden our scope to contrast the essential motive of platform capitalist firms in the collection of huge masses of data. Large cities and metropolitan areas, and in particular urban centres that have become hegemons in the collective imagination, function as living labs for key companies in western urban economies. For 'the new prophets of capital,' as Nicole Aschoff (2015) has called them in the latest book, global digital platforms tend to present themselves as philanthropic while conducting business in the name of the 'common good' (Rossi, 2019).

In pointing out the significance of the UDP as a separate concept, platform urbanism is conceived of as an emergent condition of the urban and a new field of study in which the concept of the UDP resonates. The proposed operationalised definition of the UDP is to emphasise that is not-for-profit, designed for small-scale and local initiatives in which the type of provision is Peer-to-Peer (P2P; Benkler, 2006), and often requires the intervention of the local state. With a proper conceptualisation of the UDP, critical urban scholars can start to shape social and economic relations in a different way as opposed to reducing our role as researchers to mapping the 'impact' or negative effects of digital platforms. The attempt by Leszczynski (2020, p. 189) is indeed "a counter-topographical minor theory of platform urbanism," which explores a more nuanced understanding of politics in platform urbanism that resonates and intersects with the definitional work of UDP presented in this article.

The article is structured as follows: The second section revises the main contribution that digital platforms, from an interdisciplinary perspective within media and internet studies, have made to digital geography. The third addresses the definition of the UDP with particular attention to the two cities analysed, Milan and Amsterdam, in which instances of UDPs are observed. The fourth is a level of abstraction on how the concept of 'the stack,' proposed by Bratton (2016), might engage and enrich the definition of the UDP as a separate analytical category and a gloss to platform urbanism as a new field of research.

2. From Digital Platforms to Digital Geography

According to Leszczynski (2017), digital platforms are disrupting what has become established within the 'field'

of long-standing geographical concerns, pushing for new lines of inquiry. The digital turn in geography has called for scholars to investigate how "geographies are produced *through*, produced *by*, and *of* the digital" (Ash, Kitchin, & Leszczynski, 2018, p. 25, emphasis in original). However, the epistemological approach from digital geography does not address the diversity of global digital platforms that operate in the urban context (and benefit from the infra density in order to increase extraction of value) versus the local solutions which support citizen-based initiatives and small scale urban projects that are unique to the place and social structure of that particular city.

2.1. Digital Platforms

Existing research within internet and digital media studies has generated a rich set of analytical categories on the social implications of digital technologies, including platforms (Pasquale, 2015, 2018). Those analytical categories offer a critical reading of the largely negative social consequences of the various technologies that increasingly shape the digital infrastructures of everyday life (Greenfield, 2017; Hine, 2017; Kitchin & Dodge, 2011). Digital platforms have multiple shapes: corporate, commercial, non-profit, crowd-sourced, on-demand, all bringing in a multitude of activities, services, exchanges, forums, infrastructures, and ordinary practice (Langley & Leyshon, 2017).

As Tarleton Gillespie (2010) argued, the term 'platform' clearly does discursive work for commercial entities such as Facebook, Amazon, and Google. It allows them to be variably (and often ambiguously) described and imagined as technical platforms, platforms for expression, or platforms of entrepreneurial opportunity. Following up on this, Gillespie (2018) described at length how platforms actively curate, choose, and select content. Grounded in media and communication studies, Gillespie (2018) blends a political economy framework to show how technologies shape conditions of public discourse and public values, with a hint of the normative vision in the analysis of policies that deal with digital platforms. Within this field, one of the attempts to define any kind of digital platform is proposed by Gillespie (2018, p. 207):

> Platforms constitute a fundamentally new information configuration, materially, institutionally, financially, and socially. While they echo and extend traditional forms of communication and exchange, they do so by being, like computers themselves 'universal machines' for many different kinds of information exchange…moderation, far from being occasional or ancillary, is in fact an essential, constant, and definitional part of what platforms do. I mean this literally: moderation is the essence of platforms; it is the commodity they offer.

The current debate on digital platforms usually refers to hyped discourses on the 'sharing economy' (cf. Botsman & Rogers, 2010; Frenken & Schor, 2017; Richardson, 2019) and 'gig economy' (Woodcock & Graham, 2019), as well as key firms in the sector such as Airbnb, Uber, and Deliveroo. According to van Doorn (2019, p. 1), digital platforms such as Airbnb should be understood as "new urban institutions transforming relations between market, state, and civil society." As van Dijck, Poell, and de Waal (2018) indicate, digital platforms are indeed reshuffling public and private values, as well as democratic processes. Schor (2016) insists on the fact that the type of provider and the orientation of the platform is crucial to understand their effect and impact on society. Table 1 shows what is widely discussed is the type of provider and the kind of platform orientation; some of the well-known platforms are P2P and Business-to-Peer (B2P). Although Airbnb, Uber, and Deliveroo are P2P, their corporative and entrepreneurial character is confirmed by the type of platform orientation which is clearly for-profit in which the value is extracted by the production of relational transactions. Yet, the relationship with the city is overlooked and does not help to sharpen the distinction between different digital platforms.

Anyone seeking commonalities between all these entities faces a proliferation of terms to define them, most of them loosely revolving around the idea of digital platforms serving as intermediaries. Unlike ordinary websites and apps, platforms operate at a meta-level because they bring together different players in which the relations between the parties becomes the service itself (Karatzogianni & Matthews, 2018). The primary function of this structure is to enable the formation

Table 1. Platform orientation and type of provider. Source: Author, after Schor (2016).

		Type of Provider	
		P2P	B2P
Platform Orientation	Non-profit	Time Republick (time banks) CommonFare Civic Crowdfunding	Platform Coops (Smart.Be)
	For-Profit	Airbnb Uber Deliveroo	SnappCar ShareToGo

of networks and ways of measuring and monetising activity across these networks from which value is extracted, resulting in the so-called 'platform capitalism' (Srnicek, 2017). This may result in uneven geographies in which platforms reproduce, deepen or transform existing urban inequalities (Törnberg & Chiappini, 2020).

Most of the global digital platforms mentioned have a significant urban dimension (Artioli, 2018). Without cities and users/dwellers there is nothing to deliver, nobody to accommodate, and no-one to pick up and drive around the city. Whereas the operations of platforms such as Airbnb, Uber, and Foodora are by no means limited to cities, their business models are entirely dependent on dense urban settings: there is no profit without cities to operate in. However, it is not enough to claim that digital platforms might be new urban institutions, structures, and infrastructures. This argumentation ostensibly aligns with Scott and Storper's (2015, p. 12) more general argument that:

> A viable urban theory should enable us to distinguish between the dynamics of social life that are intrinsically urban from those that are more properly seen as lying outside the strict sphere of the urban, even when they can be detected as a matter of empirical occurrence inside cities.

As a general statement, however, this espouses an urban essentialism in which the two scholars conflate the 'urban' with the 'city,' or rather reduce it to their narrow conception of the city.

What is needed, in order to understand what is inherently urban in digital platforms, is to retain a distinction between 'urban' and 'city.' For instance, Angelo and Wachsmuth (2015, p. 19) write: "Which is it? Urbanization or the city: One is a process, the other a site that is one (but not the only) outcome of that process. Surely they are not the same thing." It is then still valid that cities are large and dense urban settlements—outcomes of urban processes—and socially heterogeneous places. All digital platforms are entangled in the process of urbanisation, but not all of them can be said to be in, of, and for the city. This is also the reason why, in the next session, I explain which are the significant analytical reasons for practising this kind of sharp distinction when it comes to my study of UDPs. It is analogous to Gramsci's claim that the state and civil society cannot be separated, only to then go ahead and separate them anyway, because he finds it analytically necessary: a reluctant conceptualisation (Gramsci, 1994). To do so, I propose an operationalised definition of UDPs which are parts of an urban commonwealth whereas global digital platforms are part of an urban growth machine. Conceived this way, the UDPs don't even have to be strictly non-profit as long as they can be seen to contribute to the production of cities for and by people.

Arguably, Airbnb, Uber, and Foodora are inherently spatial in their manifestations since those platforms operate in different urban markets, such as mobility, accommodation, delivery. Any digital platforms that intermingle with the city need an existing urban community (network effect), which eventually plays out as a 'community marketplace' where social interaction is commodified through the platform in an economic transaction (Celata, Hendrickson, & Sanna, 2017). Digital platforms facilitate any type of socioeconomic activity and mediate relations, as well as organise the exchange of services, goods, capital, and labour (Artioli, 2018). However, what I observe is that in the current literature there is a larger population of corporate global digital platforms and a subset of UDPs. Hence, relatively little attention has been given to 'other' digital platforms oriented to non-profit, cooperative and bottom-up practices, social economy, and common goods, such as platforms for citizen participation, grassroot mobilisation, and urban regeneration interventions.

At first sight, one can claim that bike or car-sharing services are also urban per se. However, most of the mobility firms who provide such service are third parties or cloud platforms which collect an enormous amount of data (see the example of the Chinese company for bike-sharing, Glovo). To sharpen up the definition of UDP, I observe that they relate also to the role of the local state apparatus and material and immaterial resources which are deployed within the platform, such as local knowledge, funds, and citizens.

2.2. Geography and Its Digital Turn

The main contribution to digital platforms within media and internet studies of the city layer highlights the question of the relationship between digital networks and territory. In political geography terms, the tension between territories and networks has been widely explored, in particular in relation to state power and sovereignty (cf. Brenner, 2004; Kitchin, 2019). As Rodgers and Moore (2018) claim, "[sovereignty] is neither generalized nor homogeneous: it manifests in geographically uneven intensities and extents." In the same vein, Painter (2010, p. 1090) analyses this tension, claiming that "territory and network are not, as is often assumed, incommensurable and rival principles of spatial organisation, but are intimately connected." Since they are intimately connected, digital platforms rely on the territory and its resources, along with the user-network that uses those resources. In short, users are the active components to make these platforms work within the city layer.

Digital networks, territory, augmentation of space, and diversity are discussed in the light of the digitalisation of urban geographies. Within this body of work, the focus is onto digitally augmented nature of our towns and cities (Graham, 2014), such as how a place, a monument, a shop, or an event is represented and defined online. Digital geography research often tackles problems concerning urban knowledge and information

about space which are digitally mediated by any kind of technology, such as mapping, geo-localisation, and social media activities. The body of literature from digital geography has enriched our understanding of the relationship between digital platforms and their geography (Leszczynski, 2017). The significance of this strand is to be found in conceptual, methodological and empirical questions which address the 'digital turn' across geography's many sub-disciplines (Ash et al., 2018).

The question of networks in geography is not solely associated with accessibility to the territory in planning terms, but more about the 'findability' and the precision of algorithms to offer an on-demand match, geo-localised systems. Every kind of digital platform is designed to enhance a layer in which users, information, products and services meet, and—because the internet makes everything easy—platforms do it differently or faster. It is indisputable that global digital platforms such as Airbnb and Uber extract resources, through geo-localisation systems. For instance, when one is looking for a ride on the Uber app, the map geo-localises the user and shows that there are Uber drivers around you. In fact, these cars might be quite far from you; as a result, when one accepts the ride they vanish and the app displays the real geo-localisation of the selected driver.

Uber and Airbnb exemplify that the design of such platforms might severely disrupt the urban fabric and the labour market. As the internet-based services increasingly evolve from being a digital network that we log into, towards an assemblage of data and infrastructures that permeate all aspects of everyday life, the questions today revolve around what those changes mean for the ways that urban environments and communities are governed, planned, lived in, and challenged. Platform-based activities, ranging from Uber and Airbnb to grassroots community activism, are spatially concentrated in cities and build upon existing uneven geographies while feeding into wider urbanisation dynamics of economic development, environmental action, and everyday life (Evans, in press).

Graham's (2005, p. 571) work on software-sorted geographies claims that "spaces which escape the reach of regressive software-sorting systems do and will remain. A politics of transgressing, resisting, and even dismantling such increasingly inequitable systems is possible." If in the past, the digital divide was measured in terms of accessibility to the web, nowadays it is seen more as the capability to escape from the algorithmic regime. Conversely, the notion of a digital divide obscures the fact that what divides the included from the excluded is rarely access to the digital realm in itself: nominal access does not automatically lead to inclusion in the urban or access to services and goods. Isn't the digital divide expressed not in terms of access to technology vs. lack of access but how algorithms distribute access differentially among people who nominally have access? This seems at least as significant as the ability to escape.

3. The Urban Digital Platform: An Operationalised Definition

The proposed concept of UDP is positioned within the digital geography field and associates directly to the notion of platform urbanism. It complements the taxonomy (see Table 1) of global digital platforms, their corporate or profit-oriented characters, with another type of platform, operating exclusively in the urban realm and with other motives. Hence, the article further analyses how platforms for civic engagement and grassroots initiatives might tackle different social issues, providing tools to strengthen urban communities. Conversely, these initiatives might encounter limits and obstacles related to the control of the local state, the availability of financial resources, such as subsidies and grants, lack of participation, techno-biases, media literacy, and more. Notwithstanding, digital platforms do seem to have considerable implications, geographical as well as political. In this emerging research field, the article explores, from a geographical perspective, the relationship between digital platforms and urban conditions, starting from the theoretical stance on how the urban might affect digital platforms. In doing so, I analyse digital platforms which are explicitly embedded in the city. For instance, the whole array of projects analysed in the two platforms are utterly embedded in the two metropolitan areas of Milan and Amsterdam (see Figures 1 and 2).

From a political perspective implication, within a non-profit oriented platform, networks are decentralised and data are open in terms of ownership. Data is not sold to other businesses, and information and knowledge exchange is not commodified through reviews or reputation systems, but rather they are collective goods. As Table 1 shows, UDPs are similar to co-ops which manage online platforms, in which the governance model shares the ownership of content and data are perceived as being a common good, not as a commodity for the platform itself (Scholz, 2016). What is different from the platform co-op model in the UDP is the role of the local government and the type of motive behind it. Co-ops can serve as protection for workers, such as Smart.Be which serves as a trade union for gig-economy riders. For instance, it is not based in cities, but it is a transnational entity, therefore it is not considered as part of UDPs. Besides, where UDPs are concerned, the role of urban governments cannot be underestimated. Whether they initiate and run platforms themselves or merely intervene in an ecosystem of grassroots initiatives (or both), the urban government is the single-most-important actor in shaping the local landscape of UDPs. Understanding the (dis)contents of their role (see the following interview quotes) should be a top priority for research at the intersection of digital geographies and the city. However, civic crowdfunding platforms and platforms that enhance grassroots efforts, such as Commonfare, require a closer look to capture whether or not the urban government is still crucial or if they can remain utterly self-organised.

The tool-box that I propose conceptualises the UDP and makes the definition operationalised for empirical research: Firstly, a UDP operates at an urban scale and uses/redistributes local resources, it is P2P in the provision of goods and services and offers citizen-based welfare solutions, it constitutes networks which are decentralised and whose data are open in terms of ownership (not sold to other businesses). Finally, it considers information and knowledge as collective goods, aiming to add social value and solidarity, and to contribute to public and private civic initiatives. In order to delve into these aspects and grasp the complex constellation of actors in UDPs, it is necessary to observe non-profit organisations more closely, political leaders, policymakers, as well as community activists and software developers where empirical analysis is needed. Secondly, a UDP might also need diverse actor constellations, such as technical providers and experts, and social and community entrepreneurs. The role of the local state is another important aspect. The next section explores these aspects in greater depth, supported by quotes and mapping of projects from my fieldwork based in Milan and Amsterdam.

3.1. Instances of Urban Digital Platforms: Civic Crowdfunding & Commonfare in Milan and Amsterdam

Although there are efforts to enrich the discourse around platform urbanism, with 'vignettes,' such as the social media campaign around the hashtag #deleteUber in the US, which are defined by Leszczynski (2020) as 'glitch,' there are no attempts to describe a platform which operates exclusively in the urban, which directly involves local resources and citizens. Therefore, I introduce the concept of UDP as a supplement to platform urbanism stressing the possibilities for non-capitalistic, P2P, and community-led platforms in global European cities, which might represent the same global capitalist accumulation from a political economy perspective but a different conception from US Western-based debates of the urban in terms of the morphology and social structure of a city.

Western geographical contexts and European global cities, such as Milan and Amsterdam, are prominent cities in which platform urbanism is unfolding. Within the two national contexts, Milan and Amsterdam are classified as two models which merged economic growth and global competition (ability to intercept global funds for urban development). Although this is not the main subject of the research, it is relevant to take this aspect into consideration. For example, if one looks at the real estate values, that is, the real estate prices in the two cities, you can see that they are directly proportional to their attractiveness. This dynamic is well illustrated by Hardt and Negri in Commonwealth: in terms of positive externalities (as economists call them) the two cities attract and concentrate innovative companies and prestigious universities, dynamic governments and efficient services in their metropolitan areas (Rossi, 2019). Furthermore, rare business services operate in these cities, such as tertiary services and financial hubs, as shown by the first global city analysts back in the 1990s (from Saskia Sassen to Peter Taylor). Corporate platforms, such as Airbnb and Uber, surf the length of the wave, exacerbating the existing inequalities that already exist in the two cities. From this point, there is the urge to point out that another subset of platforms exists: those that do not directly follow the same logic to attract global capital for urban development, but which aim to strengthen urban communities and (re)create social ties. However, this is not taken for granted.

A civic crowdfunding platform is a sub-type of crowdfunding through which citizens, often in collaboration with government, fund projects providing a community service, with civic and spatial aims (Davies, 2015; Gullino, Cerulli, Seetzen, & Pacchi, 2018; Pais & Pacchi, 2020). Commonfare is a welfare platform which offers complementary services, such as sharing information and knowledge and time-bank functions. For instance, one can offer an hour of babysitting in exchange for an hour of language teaching. Besides, Commonfare allows users and members of the platform to have a choice regarding privacy of their data. In these terms, they can be considered alternatives to the for-profit platforms which extract and sell their users' data at a global scale. UDPs are P2P in their type of provision of goods and services, and their orientation is not-for-profit. Main empirical findings of my research indicate that, instead of comparing private, public, and grassroot actors and bottom-up and top-down practices against each other, we need to look at the ways these hybridise within UDPs. The new proposal of UDPs is one way of enabling this. UDPs present themselves with a clear standard design, they are used to hold and distribute goods or services, diverse kind of resources, and even more importantly, social relationships. The local state is often engaged in the promotion of these platforms, as these interview quotes show:

> Civic crowdfunding is a tool to fund ideas and projects from the bottom, aimed at social inclusion and cohesion….89% of the projects promoted by the network and over 300,000 euros collected by web users show that today it is possible, thanks to crowdfunding, to speculate on different funding scenarios from public support to support social projects and new start-ups. Civic crowdfunding has been a sure bet. By co-financing those projects that are able to receive the first half of the initial funding from the bottom, we have supported more projects and we have been guided by the citizens in their choice. (Cristina Tajani, Milan Municipality, personal communication, October 2017, translation by the authors)

> We come from a time of many hierarchical systems. The government and the organizations around it are

Figure 1. Civic crowdfunding realised projects in Milan, 2018. Source: Author.

> very top-down organized and I see that people around me have the need to determine more about their own living environment. Platforms allow citizens to participate and foster bottom-up actions. (Juan-Carlos Goilo, Municipality of Amsterdam, personal communication, July 2018, translation by the authors)

If civic crowdfunding and welfare platforms become important modes of coordination affecting cities, then the way access to these platforms is organised obviously has a political dimension. UDPs are crucial drivers of new socio-economic and local governance arrangements. In my findings, the small scale of the two examples of civic crowdfunding and welfare platforms such as Commonfare—all being within the metropolitan areas of Milan and Amsterdam—interfere with local arrangements in terms of the redistribution of local resources and oppose the extractive and exploitative nature of the corporate global platforms.

In the analysis, UDPs are defined by two main principles. The first is that these digital platforms do not pursue profit per se, rather, they are socially oriented. Revenues are reinvested in projects presented within the platform, just as we saw in the platform coop model mentioned earlier. The second concerns the internal organisation, which is open and decentralised, and, in particular the ownership of data: Users own their data, they know where it is stored, and they are involved in the decisions about how revenues are reinvested in services within urban communities. In contrast to corporate digital platforms, they do not sell the data they produce, nor do they extract value from users and exploit the commons for individual benefit. In other words, the techno-social configuration of platforms such as Commonfare allows users and members of the platform to have a choice regarding the privacy of their data. The techno-social configuration means something a bit different: Here, platforms do not 'have' techno-social configurations but become part of them through use (Johansen & Fisker, 2020). In these terms, they can be considered to be alternatives to the for-profit platforms which extract and sell their users' data and operate at a global scale.

However, clearly formal requirements with regard to who is allowed to use the platform is an important dimension of access. Nevertheless, access is framed in many more often implicit ways. Besides the economic capital, such as a computer and Internet access, social and cultural capital will play a role as pre-conditions for being able to access cloud platforms. The skills needed or 'media literacy' to be effective on a platform might vary from web-design skills to using the appropriate language of the particular community of that platform (Graham,

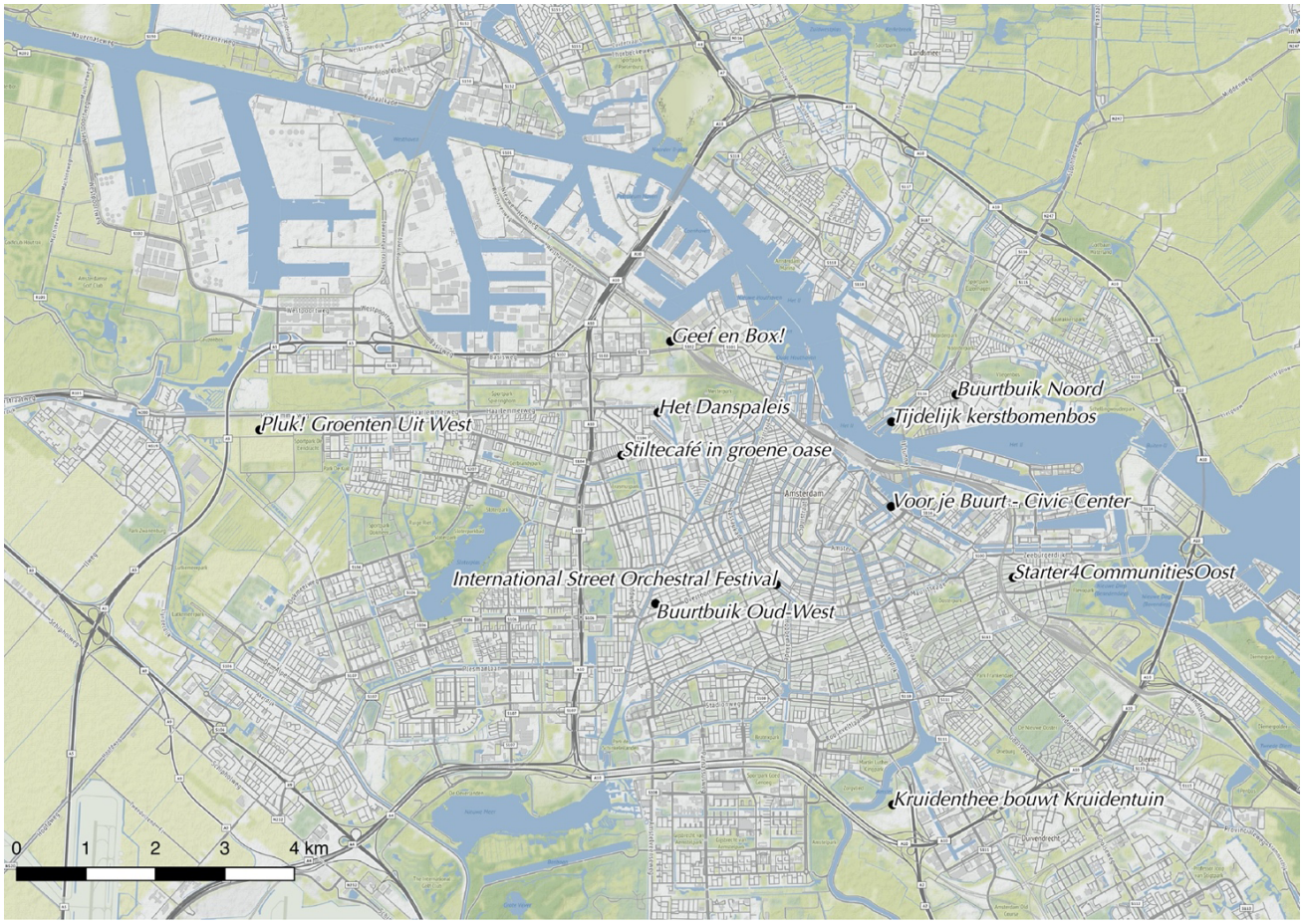

Figure 2. Civic crowdfunding realised projects in Amsterdam, 2018. Source: Author.

2014). As this quote from an anonymous civic crowdfunding project in Milan states:

> It was very difficult for us running the campaign. We do not have so many digital skills, so the online part was an obstacle. We want to collect money offline, you know we have a lot of elderly people around here who do not know how to use the platform.

Yet, civic crowdfunding can be considered bottom-up in the proposal of projects and initiatives from citizens, but those bottom-up flows are often coordinated in a centralised system by the local state or a private technical provider. The risk is the creation of new uneven geographies or the exacerbation of existing those that already exist, as UDPs tend to mediate certain information and represent certain spaces and social groups over others. UDPs can also be not-profit yet still serve the platform urbanism logic of extracting value and selling it to third parties. What is crucial as a criterion is, for instance, the ability for users and members of the platform to have a choice regarding the privacy of their data (see example of Commonfare, where data are treated as common goods). The urban scale is also a potential space to reorganise communities and resources, which shows ambivalence and contradictions as much as the concept of urban commons does. As Enright and Rossi (2018, p. 35) claim the concept of urban commons shows contradictions that shed light "not only on multiple and even competing understandings and uses of the notion of the common(s), but also on the more general ambivalence of contemporary capitalism in its urban manifestation."

The main contradictions are in the re-appropriation of those resources. While the concept of platform urbanism is loose in describing the forms of urbanisation that any kind of platforms contribute to, UDPs are already framed and conceived as a contested terrain. They are the site of experimentation which might entail cooperative relations resulting in urban entrepreneurship and both P2P and market-oriented projects (which are not antithetical). The urban scale is not, and should not, be utterly founded on centralised mechanisms such as large-scale projects or, as Bratton (2016) puts it, on 'the stack.' In the same vein, the concept of UDP serves as an analytical category to the contradictions that contemporary capitalism shows in its form of platform urbanism. In this ambivalence, UDPs rely on the challenge of different patterns of urban futures.

However, UDPs can enrich the digital urban theory which drawn both on the abstract level of the stack as a point of departure and the urban realm as essential pre-requisite to make those platform function. This is

the main reason why UDPs are inherently urban: First, they rely on the urban condition, such as the density of social relations and physical proximity between users and material resources (e.g., built environment, amenities). Secondly, UDPs often require the intervention of the urban government (e.g., civic crowdfunding) or a third sector as in the case of Commonfare. Lastly, the output of UDPs enables a redistribution of local resources and common goods and services, resulting in an alternative production of space (Fisker, Chiappini, Pugalis, & Bruzzese, 2018).

4. 'The Stack' and Its 'City Layer'

Elsewhere, digital platforms can also be understood as complex infrastructures. Media theorist Bratton (2016) refers to the 'stack,' a shorthand originating from programming work, as a fundamental layer of what he defines as planetary-scale computation based on cloud-based platforms. Following Bratton's reasoning, computational technologies such as smart grids, cloud platforms, smart cities, the Internet of Things, and automation, are defined as accidental megastructures. The stack is composed of six layers: earth, cloud, address, interface, city, and user. One of the most important elements for the conceptualisation of the UDP is the 'city layer':

> It is [in the city layer] that The Stack becomes an apparatus of inhabitation. Global urban networks situate mobility and settlement, combining physical, informational and ecological infrastructures. These form different envelopes from which architecturally-based and software-based envelopes subdivide and enforce different rights of access and circulation. (Bratton, 2016, p. 129)

Simultaneously, it has to be noticed that UDPs, or platforms in general, rely on existing platforms. An app, for example, that is used as a P2P crowdfunding (or any non-profit oriented platform) still relies on: Google's Android or Apple's iPhone, the cellular network (T-Mobile, AT&T), cloud platforms (Amazon) that the app connects to (which stores whatever central data is necessary), and internet infrastructure. In his terms, Bratton attempts to overcome the dualistic view of the relationship between technologies and physical space, and more precisely between virtual networks and territorial boundaries. He implies that those levels are now mutually constitutive elements of the city itself, as an extension of global digital infrastructure and the city layer brings up the importance of the relationship between territories and networks.

These theoretical axes are based on a potential new form of 'geopolitical sovereignty.' The link here to Lynch's (2020) piece on technological sovereignty activism in Barcelona is relevant to establish a clear connection with the city layer and the digital rights implied. This 'sovereignty' results in the management of networks which are not strictly linked to formally recognised territorial boundaries, as a form of sovereignty which is at least partially decoupled from the nation-state, which instigates a dialectic view with Graham's (2005, p. 571) work on software-sorted geographies and the concept of UDP.

4.1. Platform Urbanism as a Proposition of a New Field of Study for the concept of Urban Digital Platforms

The concept of 'platform urbanism' stems from the field of digital geography and urban governance studies and is gaining traction due to its ability to illustrate new dynamics and spatial outcomes of global digital platforms. Barns (2018, p. 23) defines platform urbanism as such: "[It] concerns the reshaping of city infrastructures and services through platform-driven business models." The dominant tendency of global digital platforms is to impose a top-down governance model which heavily affect important urban sectors, such as housing, mobility, and retail (Barns, 2015, 2019). In this notion, there is a certain emphasis on data-driven forms of urbanism and new constellations of platform governance, namely different alliances of technical experts, politicians and policymakers, citizens and businesses, as well as the fact that it gives precedence to big corporate actors mostly drawn on observations in the US and global cities (Barns, 2016). In these terms, cities are local markets for global distributors. To be so, these platforms are fuelled with local knowledge and therefore local data. Short term rental platforms and food delivery platforms exploit density, size, and associated physical proximities that characterise the urban agglomerations in which they operate. Recently, Leszczynski (2020, p. 201) enriches the initial definitional work by proposing a minor theory:

> Platform urbanism as theorized from the minor via the glitch reveals it to be a highly contingent, indeterminate, and necessarily incomplete phenomenon where erratic/erroneous configurations of platforms and cities are both the result of, and open to opportunities for, tactical manoeuvres rooted in everyday digital praxes that remake, unmake, and make differently platform/city interfaces.

However, platform urbanism and UDPs are both inherently sticky in place, UDPs contribute to this broader urban phenomenon of platform urbanism. Thus, there are two sequential forces that come into play: density and proximity in the physical space for the critical mass, *viz.* urban communities, which along with the digital infrastructure, viz. the platform, work in tandem in the production of uneven and asymmetrical urban space, viz. diversity. In both cases, information and knowledge are targeted in a specific way, digital platforms list and direct users to specific locations in the city via extensive use of maps and geo-localises providers and users. They do benefit from these elements and in fact, they depend on them. Table 2 is an attempt to itemise different digital platforms and show the diverse output.

Table 2. Itemisation. Source: Author.

Platform Urbanism		
UDPs (not-for-profit, grassroots)		Global Digital Platforms (corporate/business)
Civic crowdfunding (local state intervention)	Commonfare (i.e., mutual aid, tokens, self-organised)	Airbnb Deliveroo Uber
Output: Alternative, redistribution of local resources and common goods and services		Output: Platform Capitalism, extraction of values values and exploitation of resources

While platform urbanism is a new field of study and broadly interrogates the platform-mediated urban condition (Rodgers & Moore, 2018), the UDPs feature the novelty of the concept which emphasises the 'urban' as a battleground for alternative strategies. In the same vein of Fields, Bissell, and Macrorie (2020, p. 463), UDPs are a new concept for "geographers concerned with the digital urban interface are working to think about the potential for a counter-politics that is not rooted exclusively in resistance or antagonism." Finally, the article does not intend to set a false binary between platform urbanism and UDPs, rather as a continuum between these relevant concepts.

5. Conclusion

As a conclusion, UDPs such as Commonfare and examples of civic crowdfunding platforms are still certainly not perfect in terms of minority use with respect to global platforms. Yet they are very relevant in order to analyse whether or not they will rework on urban communities and existing inequalities and how they might be made to co-exist in mutually beneficial ways along with neighbourhood associations, solidarity, and social functions in the city. In the end, this is not only a juxtaposition between terms, I consider the advent of what I define as UDPs as a moment to reflect upon the current historical conjunction, and the potential social and collective actions that such platforms can support.

However, UDP are not necessarily forms of resistance. In the two cases analysed, civic crowdfunding still requires the intervention of the local state apparatus, insofar as it is often involved as a regulator or co-founder to develop local projects within the metropolitan areas of the two cities. During the Covid-19 pandemic, the Municipality of Amsterdam launched its own state-led solidarity platform, and in Milan they decided to open up another round of civic crowdfunding. Following empirical research, I observe that citizen-oriented practices promoted on UDPs often reproduce a certain unevenness in the distribution of goods and services, prioritizing certain areas of the city over others. While Commonfare represents an alternative, self-organised and autonomous UDP, the obstacles are still evident.

A future research agenda within this burgeoning field might interrogate how and in what way can something be truly non-profit/communal if at each underlying component in the stack, data is being extracted for profit? What communal possibilities exist despite the corporate reliance, the tendency toward data surveillance, and the ways in which each of them reinforce the non-communal aspects of society? How do UDPs create opportunities within these interstices for mundane tactics to escape the algorithms and go 'down the stack,' to co-opt and resist and counter the hegemonic discourse? Tokens and cooperative relations are potential incentives, but as you well know, it is not only about that.

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Conflict of Interests

The author declares no conflict of interests.

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About the Author

Letizia Chiappini is a PhD candidate in Urban Studies (UrbEur Doctorate) at the University of Milan-Bicocca and at the University of Amsterdam (joint doctorate). Her research interests revolve around urban transformations and societal changes under capitalism. In her PhD research, she proposes the concept of 'urban digital platform' to analyse digital platforms oriented to support grassroots initiatives and citizen engagement, such as civic crowdfunding and complementary welfare platforms. It is a comparative analysis based on four years of fieldwork in Milan and Amsterdam.

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Article

The 'Analogue City': Mapping and Acting in Antwerp's Digital Geographies

Chiara Cavalieri [1,*], Michaël Stas [2] and Marcelo Rovira Torres [3]

[1] LOCI-SST, UCLouvain, 1348 Louvain-la-Neuve, Belgium; E-Mail: chiara.cavalieri@uclouvain.be
[2] Department of Urbanism and Landscape, Oslo School of Architecture and Design, 0175 Oslo, Norway; E-Mail: michael.stas@aho.no
[3] Independent Researcher, Sweden; E-Mail: marcelo.rovira@icloud.com

* Corresponding author

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Abstract
This article discusses digital geographies by tracing, mapping, and revealing a series of spaces bounded by a multiplex digital infrastructure. By proposing 'descriptivism' as a complementary approach to digital mapping, this work discloses the city of Antwerp as the intertwining of visible and invisible networks. The 'Analogue City' is the title of both a design workshop and of a collective act of mapping that progressively reveals the city of Antwerp as a set of different spaces of information flows. By engaging the notion of mapping as object and practice, this work describes the production of a multi-scale and multi-space representation, as a process of collective and performative cartography. Through the combination of different scales, spaces, and mapping techniques, the city of Antwerp is unfolded as the result of security, mobility, and social networks. As a mapping operation, the 'Analogue City' is a threefold object: (a) an interactive, intentionally large map; (b) a series of mapping interventions throughout the city; and ultimately (c) a temporary exhibition.

Keywords
Analogue City; Antwerp; description; digital skin; mapping; performative cartographies

Issue
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1. Between Digital and Analogue Geographies

Nowadays, digital transition is imposing a radical shift in the way architects, urbanists, and designers conceive, produce, and use maps. At the same time, cities are at the threshold of both a centralised and technocratic control which increasingly relies on digital information and 'big' data accumulation: Every two days more data is being produced in the world than in all of history prior to 2003 (Kitchin, 2014). As a consequence, while over the last decades cities and territories have been radically changing, their representation is becoming more and more controversial. Paradoxically, despite the large availability of data and new technologies, digital images are overwhelming the complexity of spaces while detaching the representation from the space of cities itself. This article observes 'digital geographies' as physical spaces produced by the digital infrastructure (Ash, Kitchin, & Leszczynski, 2018), starting by surveying those physical devices that act as bridges between urban and virtual space (Kinsley, 2014) and ultimately mapping a set of geographies that, while being invisible (Merx, 2017), contribute to the (re)production of urban physical spaces. This investigation has been realised through the production of an exploratory cartography during a five days interdisciplinary workshop (February 11th–15th, 2019). The workshop was part of the third edition of the 'International Design Week' held at the University of Antwerp, Belgium, whose proposed overall theme was that of 'liminality': that condition in-between, that space in transition, the time between the 'preceding' and the 'next' (University of Antwerp, 2018). Within this framework and together with the students, we proposed to explore the notion of liminality between virtual and physical space, by documenting the points where the digital infrastructure becomes tangible and visible.

The exploration was implemented via a collective act of what we could define 'performative' cartography, where the notion of 'performance' assumes a twofold meaning. On the one hand, it refers to the cartographical turning point that saw the emergence of collaborative-performative cartographies as a counter tendency in geographical studies (Lin, 2013; Verhoeff, 2012), where bottom-up and demonstrative mapping practices were strongly opposed to the traditional top-down desktop operations. On the other hand, we make use of the notion of 'performative' for engaging mapping as a practice rather than as an object, namely as a cultural practice in the process of its making, as an *existence* rather than an *essence* (Cosgrove, 2008; Crampton, 2009).

Within this framework, we proposed the students to distinguish between digital and physical (which we defined as 'analogue') space, and to co-produce a hand-made map of the 'digital' infrastructure of the city of Antwerp. More in particular, we stressed the 'object' map as a way for connecting it with some mapping 'practices' that we executed in space. The main output is that of a large (3,3 × 3,3m) hand-drawn and hand-built map-model. The map-model, collectively built by the students, disclosed two levels of 'invisible' connections, or two sets of hyperlinks: the first is composed by a set of 'invisible geographies' that appeared visible as traces on the map once UV lights were switched on (Figure 1); the second set of hyperlinks connected the symbols representing the physical geographies on the map with a few spots in the city where students translated those symbols in writings and signs at scale 1:1 (Figure 2).

As a title for this overall mapping exercise—both object and practice—we proposed that of 'Analogue City,' where the term Analogue is used both as the antonym of digital and as an explicit reference to the work 'Analogous City,' a plan of an imaginary city conceptualised by the Italian architect Aldo Rossi and made in collaboration with Eraldo Consolascio, Bruno Reichlin, and Fabio Reinhart for the Venice Biennale of Architecture of 1976 (Rossi, 1976). Rossi derived the term 'analogous' from the correspondence between Freud and Jung that defined the 'analogous' as the thinking by analogies, such as the contemplation of the 'sensitive' and 'fantastic' material of the past (Lampariello, 2017). Asserting this definition, Rossi proposed a plan of a city made out of architectural projects, or pieces of them, derived both from contemporary, imagined and, most importantly, historical architectures (Lampariello, 2019; Rodeghiero, 2016). The 'Analogous City' is a plan that connects by analogy pieces of map with pieces of reality, of imagination, and of history; a plan where architecture has been derived out of its context. In this sense, while Rossi's

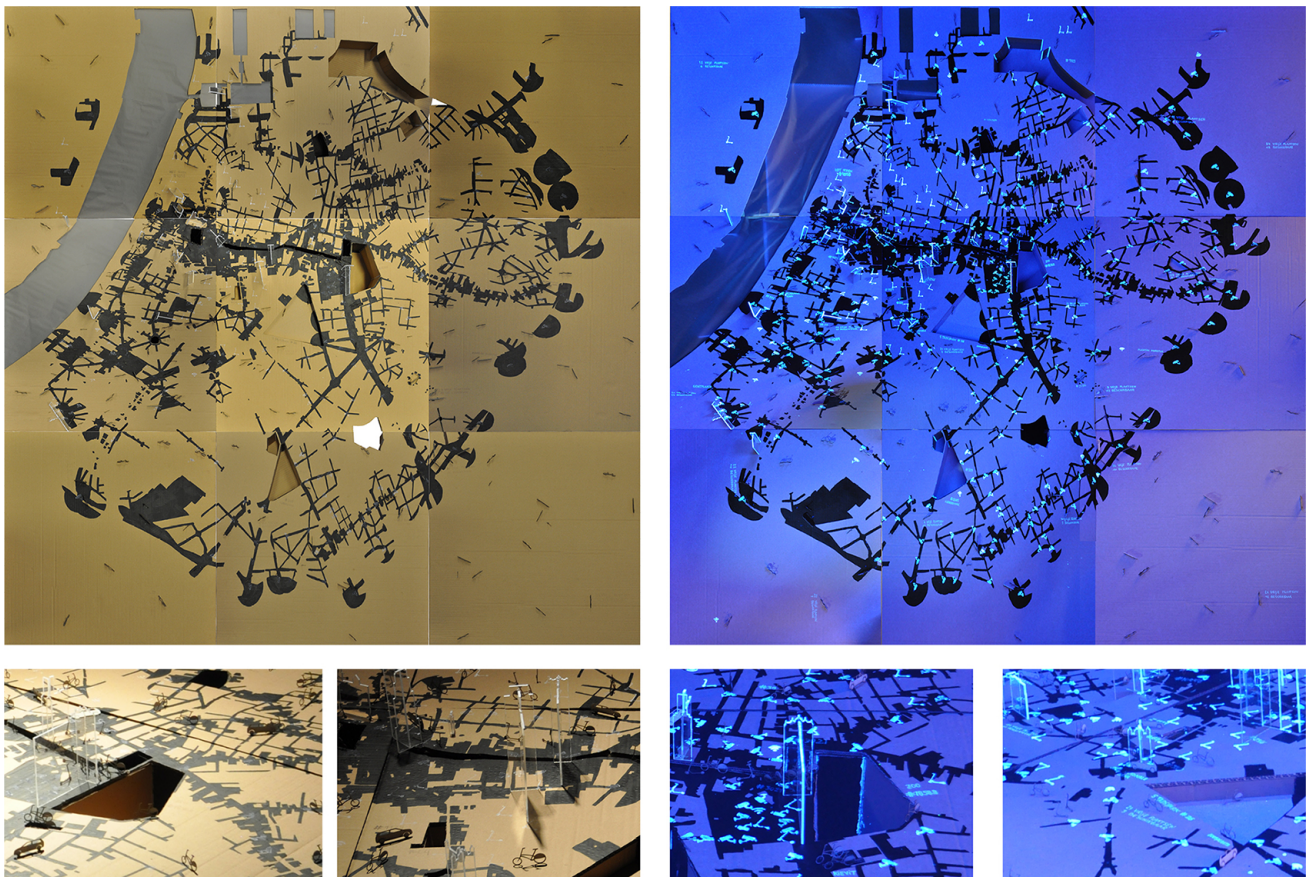

Figure 1. The two configurations of the 'Analogue City' map: under ordinary light (left) and under UV-light (right). The UV-lights were turned on upon filling out a questionnaire about the influence of digital devices on the city of Antwerp. Source: The 'Analogue City,' IDW University of Antwerp 2019 students, and the authors.

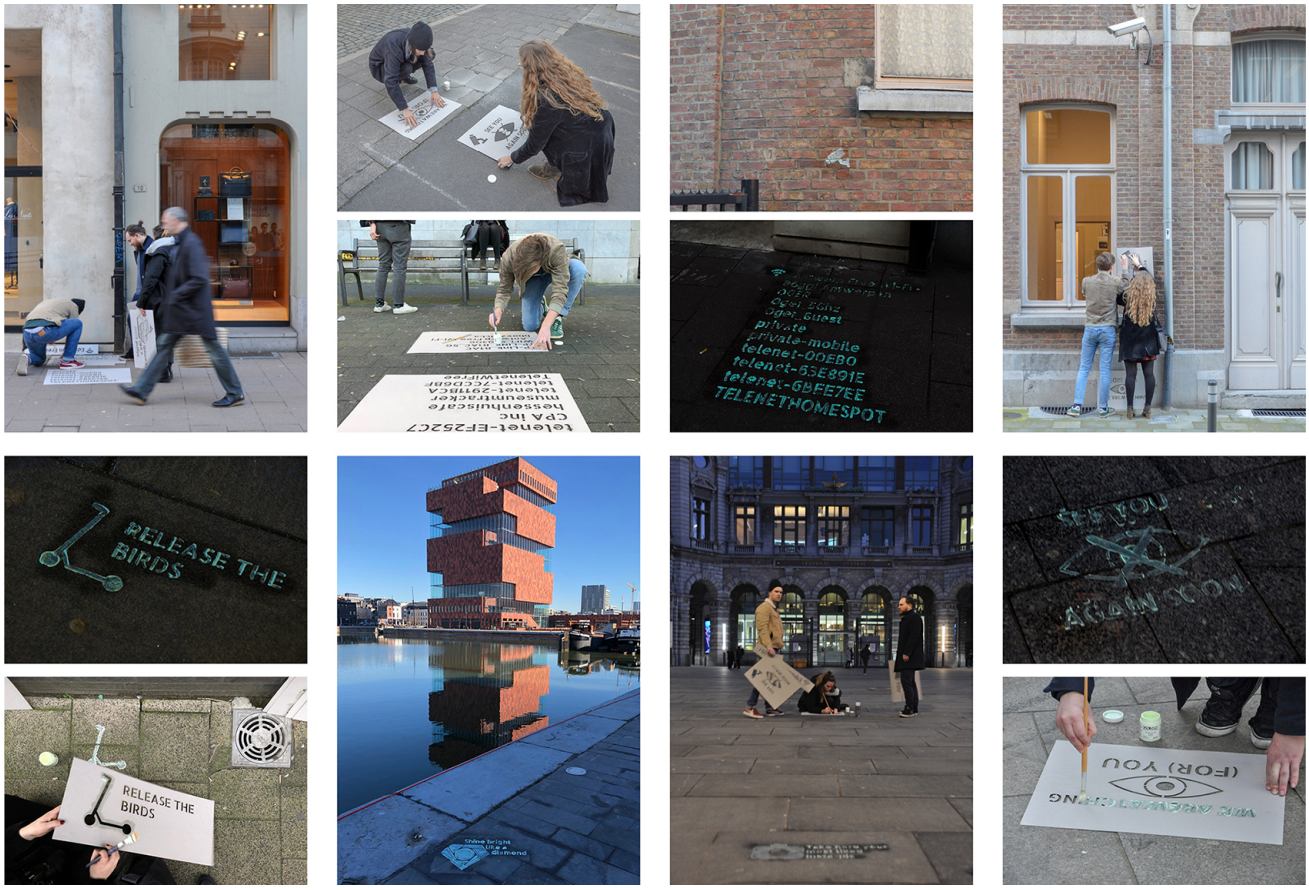

Figure 2. Process and effect of interventions in the space of the 'Analogue City' that were painted with fluorescent paint and as such became more present after sunset. The street paintings served as hyperlinks connecting the data-points of the 'Analogue City' map with their actual place. Source: The 'Analogue City,' IDW University of Antwerp 2019 students, and the authors.

interest lay more in that of a dimension of surroundings and memory, our 'Analogue City' rather looks at the present of an or any 'realtime' city. Nevertheless, we share with Rossi the materiality of his 'Analogous City': the 'Analogous City' is indeed also an unusually large object (2 × 2m), a handmade collage produced for an exhibition whose intention was that of reshaping collective imaginaries around the subject of history. In this sense, we could argue that the 'Analogue City' aims to sensitise the public while visualising a series of invisible yet existent geographies; geographies that we observed within the space of digital infrastructure, as conceived by Blum (2012) and Starosielski (2015) or explored by Nancy Couling (Couling & Hein, 2018); geographies that ultimately are problematised by Graham and Marvin (2001) as a network that intertwines with the urban landscape, from the local level to a planetary scale (Brenner & Schmid, 2015), where the notion of 'extended' urbanisation further translates into that of extended networks (Morata, Cavalieri, Rizzo, & Luciani, 2020). In particular, our attention first focused on 'everyware' devices (Greenfield, 2006) such as for example wi-fi, shared mobility devices, money transfer hubs, traffic and control cameras, waste collectors, weather sensors, and water level monitors. These are devices that reveal the connection between flows of information and urban space, which represent the input and output of such information within cities and territories, and which embody the ultimate shift in-between information flows (invisible) and urban space (visible). In other words, the digital infrastructure is here conceived as suggested by Rabari and Storper (2015), as a 'deep' *skin* that shapes the physical urban space, as the bridge in between 'virtual' and 'physical' space, between quantifiable and unmeasurable information.

2. From Digital Geography to Descriptive Urbanism

The proposed method refers to recent traditions of both surveying the digital in the city (Greenfield, 2006) and of surveying the city by experiencing and walking it (De Certeau, 1984; Secchi, 1992). Within this framework of reference, the increasing role and influence of 'digital' as both a support and a subject of urban analysis can be credited as the result of a twofold trajectory. First, surveying the digital can be considered as a consequence of the geographic 'quantitative revolution' (Adams, 2001; Barnes, 2004; Harvey, 1972), par-

tially related to the prosperous development of statistical and quantitative analysis in the field of cartography since the 19th century (Akerman & Karrow, 2007; Chapel, 2018). Secondly, digital as a way of mapping symbolises the stabilisation of a specific 'style' of urban analysis, one based on data, figures, and quantitative analysis; on the idea of "dimensioning" and "standardising" spaces and plans (Palermo, 1992; Secchi, 1995a); on prescriptive and predictive approaches. In this sense, the emergence of critical cartography (Harley, 1989) as a reaction of this twofold trajectory also becomes pioneer in preceding a series of 'counter' cartographies that started to emerge during the 1990s. During this decade, the diffusion of mapping as both a participative, indigenous, community based, ethnographic practice (Lin, 2014) and as the output of a *descriptive urbanism* (Secchi, 1992) started to build a consistent body of knowledge that countered the increasing development of technology, by introducing multiple and alternative perspectives through which it critically read the notion of 'digital geographies.'

Among these perspectives, 'Descriptive Urbanism' represents a current that, while contrasting a positivist approach such as a 'quantitative' one, proposes a set of on-field tools as means for building an 'experienced' knowledge of places. The term *description* as a way of analysing city and territories was coined in the early 1990s by the Italian urbanist Bernardo Secchi. For Secchi (1995b), description is a 'dense operation,' one that: (a) listens; (b) surveys; and (c) analyses people and spaces within their own environment. Description is a process that cannot disregard the direct experience of places, one which seeks the specific and the local rather than the generic, one where the differences become persistent (Secchi, 1995b). Description is then the result of an intense process of walking, field-working, interviewing, sketching, picturing, selecting, delayering, and recomposing; an extreme effort of translating the urban reality into the space of paper. Replying to a call of the same Bernardo Secchi for an international seminar whose title was 'Describing Territory' (30.03–1.04 1995, Prato, Italy), André Corboz (1995), historian of architecture and urbanism, defines description as an active, never-ending and necessarily selective operation that inevitably ends by transforming, and thus designing, the very same object of observation. In this sense, describing means both 'reading' and 'writing' the territory. A few years later, within the same line of thinking, the Italian geographer Giuseppe Dematteis (1995) defines this manifold operation as an "implicit project," a descriptive and never neutral one (Viganò, 1999). A few years later, and within the same framework of thoughts, the act of *mapping*—as the result of diverse operations—started to gain a certain autonomy and specificity in designating a powerful tool for design investigations (Corner, 1999). In this perspective, *mapping*, as both an object and a practice (Crampton, 2009) empowers a subjective process of understanding and translating reality according to both personal interpretation and to the intention of the mapmaker. Following such a line of thought, the direct experience of places becomes a fundamental element of mapping processes performed by architects and urbanists.

Nevertheless, despite the 'descriptivism' period, today the maps of architects and urbanists often reflect the influence of both 'quantitative' and 'qualitative' cartography, and hence intertwine 'descriptive' with 'computing' operations. In this sense, maps diversely balance the use of qualitative and quantitative observation, of a direct and indirect experience of place. We can then argue that maps are often the results of two main *traditions* of analysis—that of 'describing' or 'computing': the former observing urban structures, resulting from surveying processes, sourcing from direct experience, supporting descriptive analyses, and ultimately designing spaces; the latter rather observing urban societies, resulting from computing processes, sourcing from statistical data, supporting predictive analyses, and ultimately spatialising quantities. Beside a general 'territorial turn' in architecture and urbanism during the early 1990s (Cavalieri & Cogato Lanza, 2020), over the decades, these two *mapping* dimensions of *describing* and *computing*, featuring a respectively more humanistic and a more scientific approach (Travis, 2014), have cyclically returned to the vocabulary of architects and urbanists. With that respect, this work proposes to explore the space of computing with the tools of description, of a field survey; to observe, conceptualise, and categorise the digital as an experienced infrastructure. Moreover, by proposing to survey by walking, this work inevitably refers to the field of psychogeography—as both to the Situationists experience and to the work of Kevin Lynch—and refers to their reconceptualising and retracing the city as a sum of '*unités d'ambience*,' as different series of spaces connected by sensible, invisible, and not automated rules revealed by an intensive work of experiencing, field-working, and '*dérives*' (Wood, 2010).

3. Mapping Digital Geographies

At the beginning of the workshop we had a clear output idea—that of a big handmade map—but we missed the collective exploration of places and the consequent elaboration and conceptualisation of the categories of spaces we wanted to represent, that is to say, the legend of our map. This legend was given shape during the workshop week and, most importantly, resulted from a continuous discussion with an interesting and interested group of master students (Simón Cebrián Saiz, Emma Claassens, Stijn Clavie, Sofie David, Ward Mertens, Yulian Peetersa, Estefania Prado Clavijo, Stef Talboom, Ot Van Eysendeyk, Ellen Van Hove, Bram Van Hoye, Dorian Van Spaendonk, Hanne Verbauwhede, Roela Waegemans). The students, despite coming from quite diverse programs (architecture, interior architecture, product development, heritage studies, urban planning), shared—together with us—a common understanding of 'design as a culture.' The following paragraphs illustrate the

methodology elaborated and then applied in performing this experience: Firstly, an understanding of the context (Section 3.1), and secondly a selection of critical *spaces* (Section 3.2).

3.1. Describing Antwerp: The Presence of the Digital

The study area for this experiment was the city of Antwerp, the same city where most students lived. A space we started to observe, reconceptualise, and ultimately map from a different perspective, that of invisible flows of information. More precisely, we studied and interacted in the area between the river Scheldt and the ring road surrounding Antwerp's city centre within a square of 5 by 5 kilometres (Figure 3). Furthermore, this area, beyond representing the students' everyday habitat, contains a high concentration of digital infrastructures: The same area hosts the collaborative project 'The City of Things,' a project developed between the City of Antwerp, the Flemish Region, and IMEC, a world-leading R&D and innovation hub in nanoelectronics and digital technologies. From 2017 to 2019, the city of Antwerp has been the test-site of their 'Smart City Living Lab,' which focused on four strategic priorities: mobility, security, sustainability and digital interaction with citizens (IMEC, 2017). For this purpose, a fine-grained network of smart sensors and wireless gateways was installed around Antwerp's buildings, streets, squares, and other city properties.

Within this specific context, the students were asked to perform a description of these spaces that had to be done with the traditional tools of descriptive analysis. A description whose main objective was that of becoming a 'performative act,' that is to say of sending a clear message to the public about such a massive presence of digital infrastructures, data production, and recording within public -and private- realm. To archieve such an objective, the fieldwork played a key role: a situated, selective, and rather slow act (Secchi, 2000) of experiencing places and interacting with their users, a process that is clearly radically opposite to the speed and the a-selectivity of data generation, registration, and accumulation.

To stimulate the students' thinking and critical reflection we set up a collective fieldwork, where we were accompanied by the artist Maarten Inghels, author of the artwork 'The Invisible Route' (2017). This artwork is a cartography that, thanks to a 'descriptive' survey on field (on June 21, 2017), reveals the only remaining north-south route in Antwerp that falls entirely outside the 'controlled' space, that is a path devoid of both public and private security-cameras. This revealing—and yet still incomplete—map of Antwerp, while showing an extensive 'security' network, became a source of inspiration for the students' work.

Moreover, during the fieldwork we walked through the St-Andries neighbourhood, gated as a 'Smart Zone,' where pedestrian and biker movements were registered and studied in order to adapt traffic lights in real time, increase the safety of crossings, and the efficiency of movements by soft mobility users. While walking, observing, discussing, and sketching, the fieldwork represented the first act of a rather collective work of revealing.

3.2. Layering Digital Infrastructure

In the next two days, on the basis of the information collected during the fieldwork, open discussions, and small individual researches, we—tutors and students—

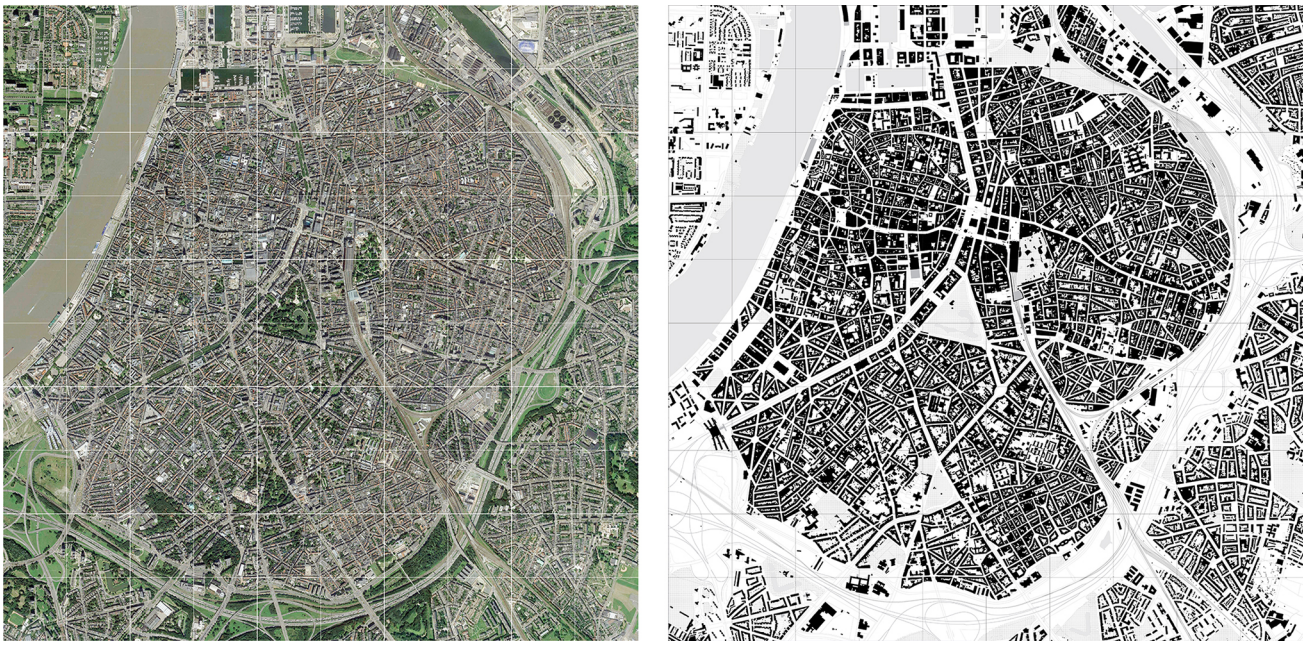

Figure 3. Area of 5 × 5km of Antwerp, city and subject of the 'Analogue City' workshop. Left: Aerial picture. Source: Google Earth. Right: Urban footprint. Source: Geopunt Vlaanderen.

defined different digital categories to be investigated more in depth. These categories represent the base for the 'Analogue City' map. During the first discussions, several themes and ideas emerged: Some of them evolved further, others were added, and some were discarded due to being too difficult to grasp or to map within the given time frame. For example, we excluded the idea of mapping geographies generated by smartphones, not only because of the impossibility of dealing with continuously moving devices from which we could not retrieve any data, but also because our understanding of 'digital' aimed to go beyond the obvious equation 'digital' = 'smart'(phone), and reflect on the digital as part of the urban infrastructure (along with the most classical of energy, waste, water, etc.). By the third day these discussions resulted in the selection of three main layers that were to be traced, revealed, and mapped. The first layer (a) examined the spatial traces of the growing use of shared mobility; (b) the second layer considered the image of the city as perceived through social media, analysing the density of 'digital monuments'; and finally, the third layer (c), rooted in the work of Maarten Inghels, explores the spatial figure of an extensive network of security cameras.

While considering and evaluating this selection, it is important to bear in mind that this exercise was performed in five days, and that the main objective of this cartography was that of revealing 'digital geographies' rather than that of being exhaustive both in the choice of themes and the gathering of the ultimate dataset.

For the shared mobility (a), out of a plurality of options spread out in the city of Antwerp, we decided to explore a set of diversely dynamic devices, by selecting: the more 'dynamic' electric scooters, focusing on the company 'Bird'; the 'semi-dynamic' Antwerp City-bike network; and the 'semi-static' shared-car system of the company 'Cambio.' The main difference between the three observed cases is their degree of 'flexibility' of pick up and drop off points: Bird-scooters have no designated drop off points, whereas the City-bikes have fixed drop off points but they can be indiscriminately delivered in any of the different stations (semi-dynamic systems). Lastly, the Cambio-cars start from and have to be brought back to the same station (semi-fixed systems). In that respect, the Bird-scooters were mapped on two moments in time, the 14th of February 2019 at 7h00 (to capture their points of departure, also determined by the movement and user patterns) and that same day at 17h00, when students leave school and universities and employees leave their work. For the City-bikes and Cambio-cars, we mapped their stations and the scale of each station as it is displayed in the map reflects the number of bikes or cars available at one of these points at a specific moment in time (14.02.2019, 17h00; Figure 4).

The second layer (b) is a layer that questions the presence of social networks within contemporary space. In this chapter, students explored the facets that were mainly linked to social media, where the evaluation of their success translated into a number of posts that used 'hashtags' and 'geotags' attributed to a specific place or building; in other words, we observed how often some places are referenced on social media. This layer attempts at portraying a renewed category of 'monuments,' the digital ones. With the word 'monuments,'

Figure 4. Shared mobility patterns. Left: Map—Traces of different shared mobility features, e-scooters, bikes, and cars in the city of Antwerp. Above right: Picture of City-bike station. Right below from left: Depiction of mobility in the 'Analogue City' map; street painting marking the data point of the map. Source: The 'Analogue City,' IDW University of Antwerp 2019 students, and the authors.

we not only refer to protected 'heritage' but also to those buildings or spaces that become key in gathering everyday social life (Secchi & Viganò, 2011) in the city of Antwerp. For the sake of time, we decided to adopt a deductive approach, where first the students, based on their own experience of the city, listed potential 'monuments', and then they looked up the hashtags that were used in referencing each selected monument. The amount of posts on Facebook and Instagram that had been geotagged were then counted and plotted on a bar chart. This list of places had to be represented on our map, and thus, in order to obtain a scale of value that could translate differences into an effective visual representation, the number of posts was plotted onto a logarithmic scale with a 10 base. This operation resulted in a sufficiently varied scale of values that allowed us to redraw the silhouette of 'digital monuments' where their height represented the quantity of post, rather than the physical features of the building. As for their visual rendering, each 'digital monument' was cut out of acrylic plastic and placed on the map (becoming here a three-dimensional object), thus picturing a new skyline of 'invisible appreciation.' Finally, those 'monuments' that are open spaces—rather than buildings—were represented as sunken surfaces on the map, creating a relief where the depth corresponds to the counted data (Figure 5).

Finally, the last layer (c) is inspired by the work of Inghels in 2017. Since the 1990s, surveillance cameras have become an increasingly present feature in both public and private domains of cities. Ever since this new geography triggered a continuous debate that either defended their purpose of rendering public spaces safer and reducing crime, or contested the reduction of privacy caused by being continuously watched and recorded. Framed in one sentence, we defined these (security) cameras as always and everywhere 'watching (for) you.' In this scheme, the work aimed at generating a new image of open space, a sort of inverted 'Nolli plan' where the black, that traditionally depicted private space, instead became the space of control. For the sake of simplicity and the construction of the mapped image, we did not distinguish the different types and characteristics of surveillance cameras. Instead, we represented them homogeneously covering a range-radius of about 125m. To provide the information for such a complex layer, the students started by transcribing the already extensive, but yet incomplete, network mapped by Inghels in 2017. Through several on site explorations, the students then verified and updated that initial 'database,' limiting their observation to within the Antwerp ring road. However, despite the resulting image being quite precise, it can be deemed to be incomplete and certainly no longer up to date (Figure 6).

4. The 'Analogue City'

Besides the selection of themes and their visualisation on a map, the 'Analogue City' as an act of 'performative cartography' ended up as being much more complex object, a process that produced three different spaces or levels of readings: (a) that of a hand-drawn large map, as the result of the act of surveying, conceiving, and ultimately transcribing Antwerp's digital 'skin' onto a map;

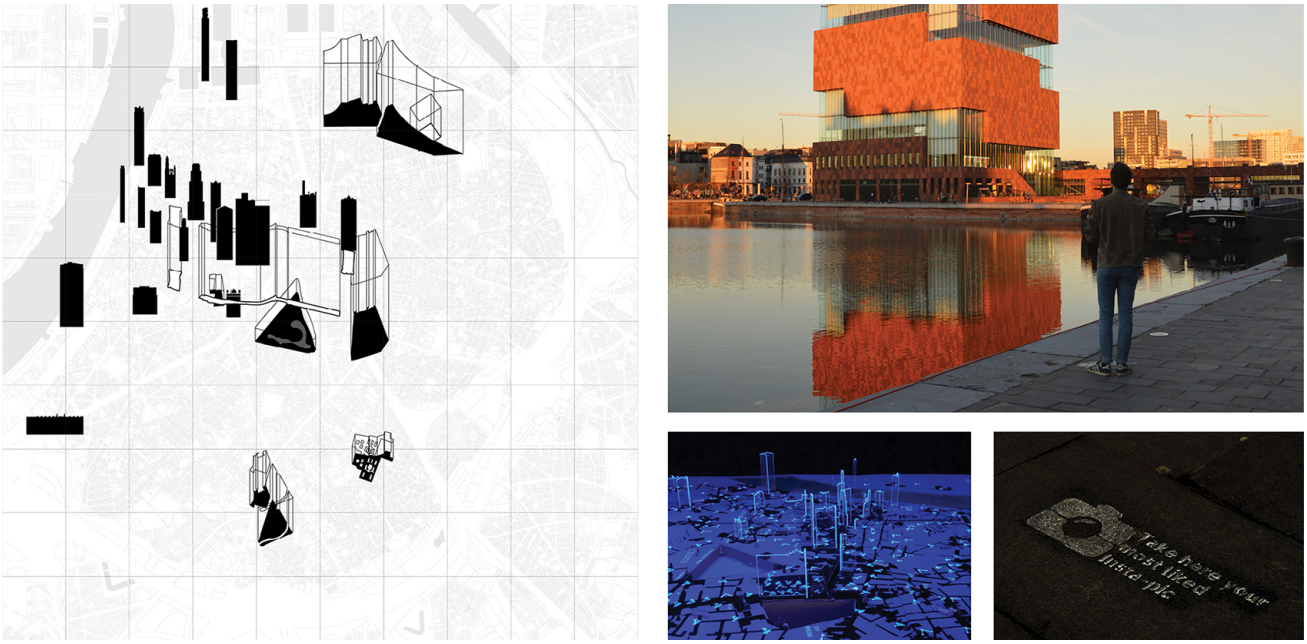

Figure 5. 'Digital monuments.' Left: Map—An image of some of Antwerp's most digitally present icons and public spaces. Above right: The MAS Museum, one of the most digitally present monuments. Below right, from left: Depiction of digital monuments in the 'Analogue City' map; street painting marking the data point of the map. Source: The 'Analogue City,' IDW University of Antwerp 2019 students, and the authors.

Figure 6. Surveillance. Left: Map—'Watching' (for) you (the map covers the large majority of surveillance cameras within the public domain that were detected during the workshop. There might possibly be more). Above right: Image of spaces controlled by surveillance cameras in the centre of Antwerp. Below right, from left: Depiction of cameras visible under UV-lights in the 'Analogue City' map; street painting marking the data point of the map. Source: The 'Analogue city,' IDW University of Antwerp 2019 students, and the authors.

(b) that of some punctual interventions 1:1 in space, sort of hyperlinks in between the space of the map and that of reality; and lastly (c) a scenography that ultimately turned the same map into a temporary installation.

As a map (a), the 'Analogue City' is a three-dimensional object of 3,33 × 3,33m, portraying a frame of 5 × 5km of the city of Antwerp on a scale of 1:1500. As pointed out, the map is the result of a collective operation, one of surveying, elaborating, conceptualising, and gathering our own digital geography onto paper. The physical outcome is an intentionally large object, one able to gather people around it and to employ its own materiality to ultimately generate debate about its (in)visibility.

The second level (b) is that of reading the double links of the map: On the one hand, a family of links within the same map, a set of symbols of invisible geographies (mobility, social network, and security control) that appear and disappear thanks to the combined use of UV lamps and fluorescent ink; on the other hand, some of these places (the position of scooters, monuments, and security cameras) have been translated in physical space in the form of fluorescent signs or wording that glow in the absence of daylight. In other words, the three families of digital geographies have been translated into punctual interventions throughout the city of Antwerp, where fluorescent ink painted on the ground or on the walls of buildings had the same effect in physical space as the UV ink on the map. Mirroring the themes of the maps, we painted some disappearing positions of a Bird-scooter as indication of the shared mobility digital infrastructure, we highlighted the best points to 'take your Instagram picture,' pointing out the presence of 'digital monuments,' or ultimately we traced the surveillance radius of some security cameras (Figure 2) in order to reveal the invisible border of spatial control. This sort of site-activation act aimed at provoking a reaction both during the process of their making, through discussion with people in the space, and in their final form, as markers of an invisible presence.

Lastly, as a three-dimensional space, as a scenography (c), the 'Analogue City' was a dark room built around the map and that contained all these materials. This third space is a temporary one, collectively built and inaugurated on the fifth and last day of the workshop and exhibited for two days. In addition to the 3,33 × 3,33m map, inside the room we implemented a general questionnaire that raised basic questions about data production in the city. The quiz ended with a button (hand-built by the students of the Product Development Program) that covered an invisible switch that turned the regular lights off and the UV lights on for ten seconds, thus revealing the 'invisible' within the materiality of such a map. Along with the dark room, the exhibition featured other materials exhibited in the same installation rooms that described the process of making (using wording, drawings, and pictures; Figure 7).

5. Mapping between Analogue and Analogies

In the case of the above-described experiment, the use of cartography as both a knowledge producer and

as a performance enabled the reading both on paper and in space of some otherwise invisible yet tangible geographies. Despite the limited time, the necessarily superficial investigation of the selected topics, and the at times inevitable incompleteness of information gathered, the overall process of mapping has anyhow fulfilled the main objective of engaging students and people with a dimension—that of the digital infrastructure—that might tend to be overlooked in people's everyday urban encounters. By collecting the data directly from the field, rather than from given datasets, the link between virtual and physical is reinforced rather than abstracted. For instance, in the mapping of the camera surveillance each point on the map not only represents a camera but is also connected with the spatial experience of that specific location. Furthermore, the long process of representing information through painting, cutting, gluing, etc. as opposed to the process of data processing, actively engages the map makers as subjects within a process of translating a sensory experience into a mapping practice and vice-versa. More in general, the 'Analogue City' as an overall operation, opens up different paths of reflection. As a performance (a), it is an action that, through its three dimensionality and sheer size, is able to address a broader public—such as the passersby and the visitors to the exhibition—and thus becomes a trigger for an everyday collective discussion (Wilson, 2019; Figure 8). In this sense, the 'Analogue City' aims to shape imaginaries around the 'geography of digital' as Rossi's 'Analogous City' aimed to shape imaginaries around the 'geography of history' (Rossi, 1966). As an image (b), the 'Analogue City' is neither a nostalgic nor a utopian one, but rather an act that aims to unfold the city not only as the result of a computational system, but rather as a cultural and manifold object (Mattern, 2017). In this sense, the term 'analogue' plays within the notions of both analogy and analogous—as the antonym of the digital—for entailing the experience of the physical space, and builds its analogies in the form of an analogous map. Lastly, as an exhibition (c), the 'Analogue City' is a temporary

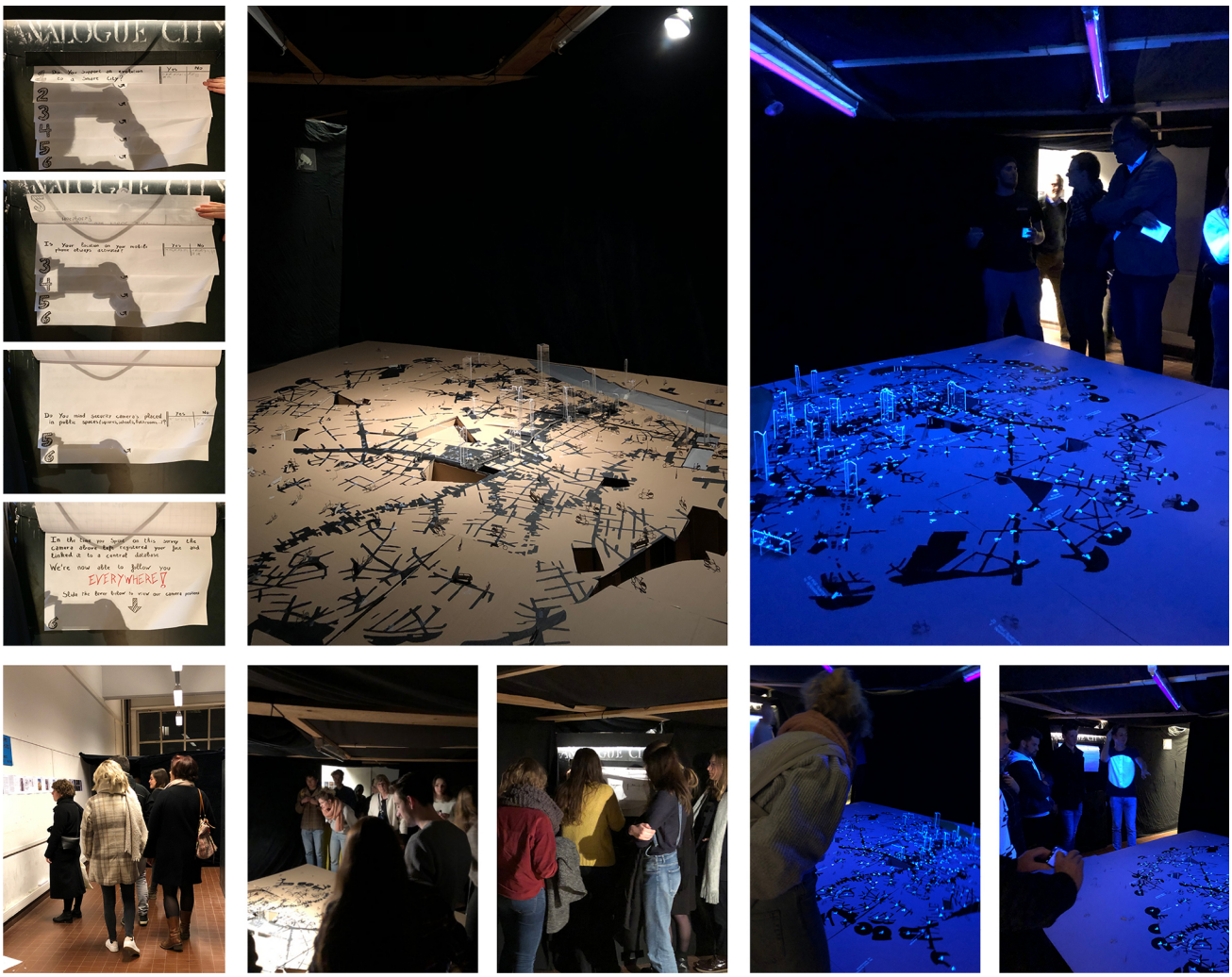

Figure 7. Exhibition at the last day of the workshop: An introduction of the explorations, leading towards a dark room that contained the 'Analogue City' map, that showed another image when the UV-lights were turned on (pictures to the right) in reaction to an 'analogue quiz.' Source: The 'Analogue City,' IDW University of Antwerp 2019 students, and the authors.

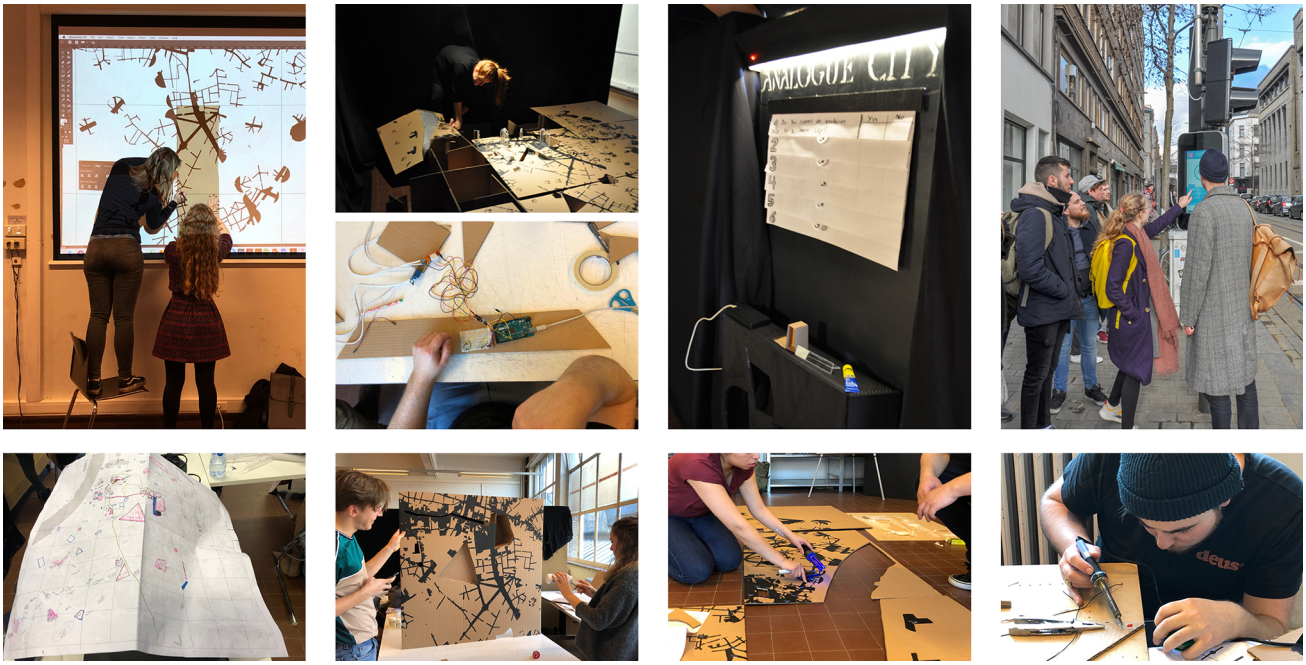

Figure 8. Process of dialogue, interdisciplinary collaborations, and creative production as an integral part of the performative cartography in the 'Analogue City' workshop at the University of Antwerp. Sources: The 'Analogue City,' IDW University of Antwerp 2019 students, and the authors.

object, one that builds strength in its provisional dimension and ultimately one that reveals analogies between the space of the paper and the physical space. Rossi's map of the 'Analogous City,' also temporarily exhibited, was a composition of architecture from the past, present and future, of both the existing and the imaginary interlacing the physical with the non-physical. By analogy, our 'Analogue City,' acts as a mapping process that collects data through a 'descriptive' analysis, hence continues on this very line of thinking by capturing that which can be difficult to quantify and combining it with conventional cartography. The core of this operation ultimately lies in the combination of two spaces—the cartographic and the physical—which is able to generate novel readings and understandings of the city itself.

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Conflict of Interests

The authors declare no conflict of interests.

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About the Authors

Chiara Cavalieri, Architect and with a PhD in Urbanism (IUAV, University of Venice), is Professor of Urbanism and Territorial Management at the Université Catholique de Louvain. Over the last years, she has collaborated and taught in the field of architecture and urbanism at a number of different schools (including IUAV Venice, GSD Harvard, EPFL Lausanne, ITMO St. Petersburg, and ENSAP Lille) and coordinated and directed several research activities and regional visions.

Michaël Stas is an Architect and Urbanist (KULeuven, IUAV). After graduating, he worked for 'Architecture Workroom Brussels.' Later, he became project leader at 'Studio Paola Viganò.' There, he worked on the 'Over de Ring' project in Antwerp. In 2018–2020, he coordinated the de-sealing program at 'Departement Omgeving.' Since July 2020, he is Co-Founder of Architecture and Urbanism practice 'fallow' (www.fallow.eu). In parallel, he has taught in the field of urbanism at several design-schools in Europe: EPFLausanne (Fall 2017), ENSAPLille (Fall 2018–Spring 2020), and AHO in Oslo (from Fall 2020).

Marcelo Rovira Torres is a Swedish Architect and an Independent Researcher in the field of architectural theory and history. He studied Architecture at the Royal Institute of Technology, ETH-Zürich, with a Master's degree from EPF-Lausanne. In 2018, he co-founded Swedish Disgrace, an initiative that aims at highlighting forgotten Swedish architecture from the 19th century onwards. Today, he runs his own architecture practice and regularly lectures at architecture and design schools, such as the Swedish Royal Institute of Technology, Linköping University, and Beckmans College of Design.

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Article

Digital Maps and Senses of Security: The Influence of a Veracious Media on Urban Life

Matthew S. Hanchard

School of Social and Political Sciences, University of Glasgow, Glasgow, G12 8RT, UK;
E-Mail: matthew.hanchard@glasgow.ac.uk

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Abstract
Digital technologies mediate our experience and use of urban space in several ways. This article argues that people trust the information provided by digital maps (such as Google Maps, Bing Maps, and OpenStreetMap), including datasets embedded within them, e.g., crime statistics and council tax banding. People choose particular sites and routes, and they make wider decisions based on digital map content. The article highlights the senses of security people gain from using digital maps, and the influence that their use has, for instance, on choices of which home to buy (landed capital acquisition), which route to take and by which mode of transport, and which restaurant or hotel to visit. As such, the article argues that digital maps influence the ways in which bodies are distributed and move in urban space. The article applies a practice theory lens to data from a scoping sample survey (n = 261), 32 semi-structured interviews, and three focus groups. Through empirical examples, it demonstrates how a sense of security provided by digital maps is experienced by users, and how that serves to influence the decisions people make in negotiating and making urban space meaningful.

Keywords
digital maps; ontological security; senses of security; urban life

Issue
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1. Introduction

Digital maps feature in people's decisions over where to go, how to get there, and in their understanding of urban space—from choosing homes to rent/buy, jobs to take, hotels or restaurants to visit, or travel routes. This article examines how people make sense of urban space through digital maps. It argues that people elicit different senses of security by using them, which influence the movement and distribution of bodies in urban space. Thus, it contributes to debates about what it means to live amidst an emerging 'digital skin' of sensors, screens, and infrastructures within contemporary urban life (Kitchin & Dodge, 2011; Rabari & Storper, 2015). For urban planning this provides useful knowledge about how a specific set of technologies mediate people's experiences of the city and how they mobilise and make use of urban space as a result.

The next section provides a technical history of digital maps, explaining how they emerged from various precursor web-based technologies whilst drawing on paper-based maps and geographical information systems (GIS). It then turns to the treatment of map use and users in map studies, noting that although attention is often paid to the moment of use, it has often come at the expense of how digital maps feature within people's lives in general. This identifies a gap in contemporary thought about the extent to which digital maps influence people's experiences of urban space. The article then builds a practice theory framework which it later uses to examine data. Next, a methods section sets out the approach taken towards data gathering and analysis, detailing the survey, interviews, and focus groups used throughout the article. The article then presents its findings: First, it argues that digital maps inform a myriad of decisions people make in their day-to-day lives over where to go and how

to get there and their overall understanding of a place. Here, it extends map studies by examining one of the ways in which maps feature in people's social and cultural lives beyond the immediate moment of use; second, the article argues that digital maps only partially inform people's day-to-day decisions, adding that when they do it through the meanings that people ascribe to their imagery, a point that extends practice theory to examine digital media as materials; third, the article shows that people tend to accord the imagery of digital maps a degree of indexicality as veracious representations of reality, and by extension as legitimate resources of continually updated and revised (and therefore emergent) sources of information; and fourth, that it is the various senses of security people gain by using digital maps as legitimate resources that inform their experiences and practices. The concluding section argues that it is the trust people place in the perceived veracity of digital map imagery and datasets embedded within them that informs (but does not fully structure) the distribution of bodies and things in urban space.

2. Contextualising Digital Maps as Different from Digitised Maps, SatNav, GPS, or GIS

Census agencies like the Office for National Statistics (2019) have provided spatial datasets on electronic media since 1966 and digitised cadastral maps have been delivered via web-based geoportals since 1993 (Land Registry, 2014). However, neither feature regularly in people's everyday lives, requiring specialised competence in statistics, spatial science, GIS, or computer-aided designs (UK Data Service, 2019). Meanwhile, satellite navigation (SatNav) systems and GIS have both emerged as mundane technologies in the public realm. SatNav (launched 1978) uses a Global Positioning System (GPS) of networked satellites (NASA, 2019) to continually survey the Earth (Milner, 2016), powering various applications from fitness trackers to logistics routing systems, which now "comprise the fastest growing sector in web technology businesses" (Speake, 2015, p. 243). Meanwhile, SatNav has become synonymous with car-driving. Both technologies offer dynamic and customisable geovisualisation, but content is not amendable by end users. Similarly, since their origin in a 1960s Canadian government experiment (Wright, Goodchild, & Proctor, 1997) GIS have matured from desktop based proprietary software to paid and open-sourced web-based applications. Many expected a convergence between GIS and digital maps (cf. Sui & Goodchild, 2011), enabling non-experts to produce their own grassroots maps (*pace* Hudson-Smith, Batty, Crooks, & Milton, 2009). Here, Perkins (2008, p. 151) notes that when "[d]esktop mapping and GIS gave the general public tools to make their own maps…[they provided a way to] interact and explore, rather than just employing the image as a final presentation." However, the data politics behind the two technologies has led them to different social trajectories, hampering any democratisation of cartography. To clarify, as technologies, "new spatial media and GIS [have been] torn in two distinctly different directions" (Crampton, 2009, p. 97). Digital maps are free to access and offer Application Programming Interfaces (APIs) for users to add/edit content as layers of a base reference map with ease. Meanwhile, GIS and cartography require specialised skills to produce bespoke maps. However, as Haklay (2013) notes, technological affordances are not value-free. He identifies, for instance, a tension at two levels in neogeography—the use of digital maps by end-user to generate their own maps (Turner, 2006). At the 'lower' level, he argues that unlike GIS, with end-user generation of digital maps "control over the information is kept, by and large, by major corporations and the participant's labour is enrolled in the service of these corporations" (Haklay, 2013, p. 67). At the 'higher' level, Haklay (2013, p. 67) adds that neogeography (like GIS) also "require[s] skills and aptitude that are in short supply and are usually beyond the reach of marginalised and excluded groups…beyond the reach of most civic society organisations." In doing so, what Haklay highlights is a tension between digital maps offering users access to generate their own map layers and a set of social dynamics over who has the competence to do so.

Although digital maps employ technologies and techniques from cartography and GIS, six precursory computing technologies shaped them considerably: (1) Microsoft's 'text-based routing' programme *AutoRoute* (launched 1988) introduced a graphical user interface (GUIs) for non-experts to generate road-like maps from any spreadsheet containing georeferenced data (Hoffman & Stewart, 1993); (2) *MapViewer* (launched 1993) enabled users to generate thematic maps and distribute them over the web, albeit to a limited scientific community (Golden Software, 2019); (3) PARC's HTML-based Map Viewer (also launched 1993) stored longitude and latitude coordinates in URL addresses, and instructed web browsers to fetch and display specific portions of a global map (held as a single HTML image; Putz, 1994). However, it was not made public (Newton, Gittings, & Stuart, 1997); (4) AOL's *Mapquest* (launched 1996) was the first web-based map to make "a huge impression…[bringing] online mapping into the public sphere" (Geller, 2011, p. 186) gaining over a million users in its first year (O'Leary, 1997). As a Javascript application (Edelman, 2015; Mapquest, 2017), it combined satellite and geocoded paper-based map data, fetching portions of a global map image on the fly. However, any "change in the map, however small, [had] to be sent back to the server for regeneration of the image" (Johnson, 2002, p. 5) requiring specific expertise; (5) Keyhole's *EarthViewer*, launched 1999 and acquired by Google in 2005 (Crampton, 2010), marked the first feasible virtual globe to "run nicely on a normal personal computer, enabling smooth rotation and zooming" (Kaplan & Lenardo, 2020, p. 208); and (6) Microsoft's *MapPoint* (released 2000), desktop software that intro-

duced the idea that maps were not just a static image, but could include "road map data (raster data from the Ordnance Survey[])]…a streetmap…and the capability to import, link, and map other sources of data held in a spreadsheet" (Green & King, 2000, p. 149) in various 'views.' Together, these precursors provided maps that were easy to access at home (without specialised knowledge or equipment), distributed over the web, and had layers of information.

Building on these precursors, Where2 launched *Expedition* in 2003, selling it to Google in repackaged form as a web-based application the same year to produce Google Maps (Gannes, 2015). Expedition placed the "map [at] the center of the display…letting people scan around and zoom in and out" (Gannes, 2015). Like AutoRoute, its GUI enabled users to incorporate data "into a map frame, including beyond the view-frame of the browser…[to] pan around…a 'slippy map'…without reloading the whole page for every minor adjustment" (Dalton, 2012, p. 84), thus marking a differentiation from the separate sheets/pages of paper-based maps or files for GIS. When Google launched *Earth* and *Maps* in 2005, they included a publicly open API and intuitive GUI enabling users to add/edit external data as layers over Google's base map (Crampton, 2010, pp. 26-27). Simultaneously, the OpenStreetMap project was "born at University College London (UCL) in July 2004" (Haklay & Weber, 2008, p. 13). However, "unlike the mashups…[that] built parasitically on Google Maps, OpenStreetMap…[adopted] an open source ethos of mass participation" (McConchie, 2015, p. 886) by crowdsourcing content. Conceptually, this meant digital maps were not defined by the base map, but through a continual revision of map content. As such, digital maps become emergent—always in a process of becoming, and therefore different to cartography and GIS where the map is pre-set before being printed or saved as static file.

Extending digital maps further, Microsoft launched a three-dimensional 'view' for *Windows Live Services Maps* (now Bing Maps) in 2006 (Bing, 2006; Microsoft, 2017). Google did the same a year later, alongside their launch of *StreetView* (Plantin, 2018). Like GPS, StreetView sought to map the whole Earth, albeit in photographic detail at ground-level via "online Kalman-filter-based algorithm" (Anguelov et al., 2010, pp. 33–34) stitching photos from car-mounted cameras together in real-time. This presented more than a map of geocoded data over a base set of coordinates. It offered a claim to legitimacy through the realism of photographic representation of place at eye-level. For some, this meant "the construction of place rest[ed] finally with a transnational corporation" (Power, Neville, Devereux, Haynes, & Barnes, 2012, p. 1034) with users unable to amend content. Although Google briefly extended "the familiar tagging and layering interface of Google maps to allow users to create or edit the base map itself" (Boulton, 2010, p. 1) in 2011 with Mapmaker, they withdrew it in 2017 (Google, 2017). By contrast, Microsoft's *StreetSide* (launched 2009) "takes directories of photos, finds commonalities, and stitches them into a seamless single-object experience…[using] Flickr photos" (Pendleton, 2010, p. 16), by crowdsourcing content from social media and creative commons photo libraries to generate a photographic view from 'volunteered' images. In 2016, Google incorporated 700 trillion pixels of Landsat-8 satellite data (Herwig, 2016) into Google Maps, providing far more detailed satellite views, removing clouds, and algorithmically stitching archival satellite data together to simulate seasonal change (Meyer, 2016). Since then, Google has focussed on mapping air quality at street-level through *AirView* (Bettman, 2018) while Microsoft has focussed on commerce and transport travel-routing (Bing, 2017).

Throughout their development, theorists have been keen to examine the influence digital maps have on urban life. Power et al. (2012) and Shapiro (2017), for example, argue that StreetView imagery stigmatises place and ossifies place-identities. Others have focussed on an emancipatory potential for underrepresented people to generate their own grassroots maps (Turner, 2006). In urban planning too, theorists have sought to examine the role of digital technologies in fostering forms of public participation in shaping cities (e.g., Douay, 2018). However, the onus across these theories has primarily been on how maps operate and what it is that they do, with the moment of use taken as the key site of study. Little attention has been paid to the ways in which digital maps feature more generally in people's lives, or what that means for the ways in which bodies are distributed in urban space.

3. Identifying How Digital Maps Feature in Social and Cultural Life as a Gap in Map Studies

The idea of map studies began with Eckert and Joerg's (1908) argument that a 'map logic' could increase accuracy and help understand use, but it was not until Robinson (1947) that anybody attempted to do so. Robinson sought to counter misinformative and propagandic maps during World War II (Crampton, 2011) by removing subjectivity, based on a positivist belief that normative representation could be reached whilst focussing on users' needs. After World War II, public demand and use of maps grew as damaged cities, towns, and infrastructure were rebuilt (Robinson, 1979) and they became everyday technologies. However, map-production remained a specialism venture. Here, Robinson sought to "regularize the principles of map design…[but also to]…establish cartography as a properly academic discipline" (Edney, 2005, p. 715). For this, he drew on architectural functionalism—where users are not expected to conform to a structure—to develop a functionalist inspired map-communication model (MCM) with spatial information passed from cartographer to agentic user via the 'neutral' mediation of a map. How people make sense of maps, however, was not considered. To date, theorists such as Board (1972)

and Morrison (1977) have sought to extend and refine Robinson's MCM, while others have sought to challenge it in various ways.

These challenges include: (1) Tobler's (1970) notion of 'analytical cartography,' which underpins GIS (Möellering, 2000)—although it shares a progressivist attempt to remove 'interferences' from the map design, it draws solely on statistical data, purposefully omitting local detail to achieve generalisation (Tobler, 1970, p. 234); (2) semiotics-based approaches focus on meanings within map content, examining the indexicality of maps, and how people interpret and read them, e.g., Schlichtmann (1985) and Wood and Fels (1986)—steeped in an underlying assumption that people share interpretive schemes; (3) cognitivist-behaviourial approaches, which assert map design can be improved by understanding how people compute and process maps (Eastman, 1985; Keates, 1996). Here, onus sits on the act of interpretation, not the use of maps itself; and (4) critical cartography which has sought to uncover the hidden politics embedded within maps (Crampton & Krygier, 2006; Harley & Woodward, 1987), treating them as "complex series of interactions, involving their use as well as their making" (Harley, 1987, p. 2) rather than as neutral indexical representations. Its challenge to map positivism has led to deep-rooted divisions amongst cartographers and GIS practioners and map theorists (Schuurman, 2000). Some have looked at alternative mappings of space and subjectivity (Cosgrove, 1999) and the politics behind map design (Black, 2002). Meanwhile, others produce alternative maps by giving voice to otherwise silenced people and narratives (e.g., Barford & Dorling, 2007; Bhagat & Mogel, 2008). It is worth noting, however, that these different approaches were not always discrete. Montello (2002), for instance, explains that Robinson's functionalism informed later cognitivist-behaviourial approaches to map design.

To summarise map studies, Dodge, Perkins, and Kitchin (2009) conducted a major review of the field and set out a landmark 'manifesto' with five modes of inquiry—interfaces, algorithms, cultures of map use, authorship, and infrastructure. With the exception of cultures of map use, they saw map studies to be focussed on design/production and on the politics of representation. However, work on the cultures of map use has produced a diverse range of knowledges about: how different cultures are formed around the production of specific maps and the circulation of ideas and material involved in their assembly (Perkins, 2008); what maps offer (as media, technologies, and cartographies) for understanding alternative and playful uses of urban space (Lammes & Perkins, 2016); errors and discontinuities in digital map content and users reactions to them in navigating urban space by smartphone as undermining of any claims to objectivity (Wilmott, 2020); and a focus on people's interactions with particular aesthetic schemes in digital maps, such as the difference between two and three dimensional map views (Dodge, 2017, 2018). Despite the diversity within the works on cultures of map use, there has been little attention paid in map studies to how digital maps feature within people's cultural and social lives beyond the moment of use. Where this has occurred, such as in Lammes and Perkins' (2016), the focus has not been on identifying their social consequences. Instead, the onus has been on developing conceptual understandings of what future cities could be.

Digital geographers and media theorists have focussed on digital maps too, examining: the development of particular digital map platforms over time (Plantin, 2018); how particular technologies might alter our future uses of the city through the automated classification of places based on external data such as crime statistics (Thatcher, 2013); the colonisation of everyday life through personal data, including geospatial being accumulated and linked and used to shape our use of space (Thatcher, O'Sullivan, & Mahmoudi, 2016); how wayfinding is enacted through SatNav systems (Axon, Speake, & Crawford, 2012) and other GPS-based navigation systems—in a return to cognitive-behavioural studies (Ishikawa, Hiromichi, Imai, & Okabe, 2008; Münzer, Zimmer, & Baus, 2012); user-centred design studies that compare paper-based maps with the interfaces of digital ones (Roth et al., 2017) to assess user experience; changes to the classificatory schemes used within geospatial dataset management as a result of digital maps' emergence (Alvarez, 2016); and the focus in media studies on the impact of digital map imagery (Google StreetView in particular) and its role in ossifying place identities and shaping perceptions of place. For example, Power et al. (2012) explain how Google StreetView serves to stigmatise a particular neighbourhood. Meanwhile, Shapiro (2017) explains how Google StreetView opens a set of data politics around what and how it represents to the world, and the likely impact on how people perceive particular places through those representations. Across these different approaches theorists have focussed primarily, as map studies has, on either the design and production of digital maps, the politics involved with the choice of what is/is not represented on the map, or on processes of interpretation. With the exception of Power et al. (2012) and Shapiro (2017), whenever digital map use has been examined, it has revolved around the specific moment of use. This leaves questions unaddressed about how digital maps feature within people's social and cultural lives beyond the immediate moment of use, what people garner by using them, and to what extend they mediate and or shape contemporary urban life.

4. Developing a Practice Theory Framework for Examining Digital Map Use

Practice theory offers a useful lens for examining how digital media feature within social practices (Postill, 2010). In first-wave practice theory (Postill, 2010), Bourdieu, de Certeau, and Giddens circumvented primacy being

attributed either to structure or agency (Couldry, 2004; Postill, 2010; Schatzki, 2001). Instead, they hold them to as mutually reinforcing. Giddens (1984, p. 25) argues the "structural properties of social systems are both the medium and outcome of the practices they recursively organise." Here, structures are understood as "recursively organised sets of rules and resources" (Giddens, 1984, p. 25) which may be divided into "cognitive and moral rules and to allocative and authoritative resources" (Bryant & Jary, 2001, p. 16). Resources can be "allocative, or material, and authoritative, or non-material [where] the former derive from dominion over things, the latter from dominion of people" (Bryant & Jary, 2001, p. 13). Rules are understood as "(codes, norms) methodologically applied, generalizable procedures of action implicated in the practical activities of daily life" (Schatzki, 1997, pp. 290–291). Giddens does not view people "as cultural dopes, but rather [as] knowledgeable and capable agents who reflexively monitor their action" (Bryant & Jary, 2001, p. 12) in skilfully negotiating and usurping rules and resources encountered in the durée of everyday life. For digital maps, this means people are not necessarily influenced into thinking or acting in particular ways based on map content, but through choice to act (or not) on specific interpretations. This differs from many map studies and media theories of digital map use, such as Power et al. (2012) and Shapiro (2017) who show that digital maps do influence knowledge about place and actions, but do not fully account for reflexivity. To explain how people negotiate structures and social systems, Giddens adds that structures exist in memory traces (Bryant & Jary, 2001, p. 16), with memory as the mechanism through which rules are drawn on and resources comprehended and acted upon (Giddens, 1984, p. 45). Thus, structures are actively brought-into-being by knowledgeable actors drawing on biographical experience to negotiate rules and resources. To explain why people draw subjectively on some rules and resources, and not others, Giddens draws on Freud, Erikson (Kort & Gharbi, 2013, p. 96), and Laing (Hiscock, Kearns, MacIntyre, & Ellaway, 2001, p. 50) to argue that early socialisation is generative of feelings of trust (or mistrust) as "the deepest lying element of the basic security system" (Giddens, 1984, p. 50)—a point congruent with the accumulation of memory traces through personal lived experiences. He adds that this trust extends to "people having confidence in the social order, in their place in society, in their own right to be themselves, and a belief that their self-realisation can be achieved" (Hiscock et al., 2001, p. 50). In existential terms, it provides an ontological security (Giddens, 1991) orientated towards the shared structures, social positions, and material arrangements of everyday life and their predictable continuity.

Second-wave practice theorists (2000s onwards) have focussed on a wide range of concerns, from philosophising shared practices (Barnes, 2001, p. 34) through to eking out positions for posthumanism (Pickering, 2001) and objectual agency (Knorr-Cetina, 2001). Within this, Shove, Pantzar, and Watson (2012) developed a simplified Giddensian framework for studying social practices. They content that practices operate at two levels: performances, as individual instances of doing; and entities, enacted, stabilised, and shared through repeat performances. Both levels are constituted through an interplay between three elements: (1) *materials* (objects and technologies) as allocative resources (Shove, 2017, p. 157) provide structures which enable and constrain particular performances too; (2) *competences* (skills and/or knowledges required to use materials)—which "can lie dormant, persisting in memory [traces] for years without being activated, or…be preserved in written forms" (Shove et al., 2012, p. 34) and other media; and (3) *meanings*—(interpreted purposes of materials) as notable in the 'associations' and 'classifications' (Shove et al., 2012) people apply.

As urban life becomes increasingly mediated by smart and digital technologies, including "work, travel, consumption, production, and leisure" (Ash, Kitchin, & Leszczynski, 2016) it becomes important to examine how technologies (including digital maps) feature within people's cultural and social lives, and on how people navigate, use, and make sense of cities through them. What a practice theory framework offers is a way of examining both what people do (their actions and the technological materials they draw on) and the meanings they ascribe to place through those technologies. For urban planning, this offers a way of examining the relationship between people's use of specific technologies to make sense of place and the practices (and use of urban space) as a result.

5. An Overview of the Data and Methods Deployed to Examine Digital Maps Use

This article draws on an online sample survey (n = 261), 32 semi-structured interviews, and three focus groups—all conducted between 2013 and 2018 (see Hanchard, 2020). The survey gathered details about how people use digital maps (and which ones), when, where, and for what reasons. Also, whether they had amended digital map content, and/or knew how. It closed with questions about the perceived accuracy and/or trustworthiness of digital map content. Respondents were recruited from across the UK by email, phone, via social media (Facebook and Twitter), and through various interest groups to ensure the widest possible demographic distribution (e.g., covering a broad range of people across age groups, genders, ethnicities, and occupational types). The gathered survey sample was relatively diverse across those measures, with the exception of age; over half the respondents were aged below 40. Although the diversity of the sample meant its findings were not statistically representative of any wider British population, and it was skewed slightly by age, the approach fit well with the overall research design. The survey—as the initial point

of analysis—was not directed towards identifying statistically significant findings. Rather, it provided an exploratory way to understand how digital maps feature within people's lives from a large number of people as a scoping exercise. It identified three contexts where digital map use was of interest: (1) the home-buying process; (2) gaining an orientation to new places (e.g., as a tourist or new student); and (3) walking in rural areas where traditional paper-based maps are outdated or lack sufficient detail (e.g., pub phone numbers, historic detail on sites). The survey findings informed the choice of three contexts from which all interview participants were recruited: home-buying; orientation to a University campus; and leisure-walking.

Gathering insights from a purposive sample of interviewees within each of the three contexts (with a sample covering different ages, ethnicities, genders, and employment statuses) provided detail on how digital map use mediates landed capital acquisition, sense of place formation, route-planning, and working with web-based technologies in both urban places and areas with limited or intermittent connectivity. Initially, nine interviews and one focus group were planned per context. In total, 32 participants were interviewed owing to participants arriving with partners, proving a slightly older sample (with over half aged 40 or above and only four participants identifying as having a black or minority ethnic group background). Previously interviewed participants from each context were invited to examine and discuss emerging themes in a focus group. Here, themes identified through analyses of the interviews were presented and discussed to gain iterative feedback on the analysis.

To analyse the data, the research followed a modified form of Charmazian constructivist grounded theory (Charmaz, 2006), with three stages of coding (open, focussed, and theoretical). After open coding verbatim interview transcripts, feedback was sought through focus groups. This helped to amalgamate and winnow the codes inductively into a set of focussed ones across all contexts. To further amalgamate the codes, the analysis was compared with map studies and practice theory literature to develop an understanding of how digital maps feature within people's everyday lives and how they mediate the experience of urban life. In the next section, quotations are taken only from the interviews, serving as illustrative examples. However, the analysis behind them was informed by all three methods.

6. How Digital Maps Influence the Movement and Distribution of Bodies in Urban Space

Digital maps influence many perceptions people have of urban spaces, their choices of where to go, which route to take, and how to get there. For example, Francis explained that if he gets hungry when wondering around the city centre, he uses the "'search nearby' feature…[to see] whether [he is] near a McDonald's or whatever." Likewise, when Dave chooses a place to eat at, he is "already on TripAdvisor" looking for reviewed places nearby, adding that if "they weren't listed, they were missed out." While Francis and Dave highlight the importance for businesses of being on the map, and the consequences of being omitted (cf. Thatcher et al., 2016), they also demonstrate how their decisions are shaped by trust in digital map content. Both find a smartphone meaningful as a material allocative resource whilst on the move, with no specific competence required to use it. Whilst their choice of site is linked to short-term consumption, Kelly describes a similar use of digital maps to buy a house:

> I used StreetView a lot to see what the surrounding streets were like….Zoom in, and have a look at people's gardens, because I wanted to see if they were scruffy or not, to give me a better idea of how well the street was kept.

Rather than just informing her choice of site, Kelly notes that the photographic imagery of StreetView also informs her overall sense of place. Here, she categorises streets with bins left outside as 'scruffy' and associates them with a place she would not want to live at. Here, digital map content serves to stigmatise place (Power et al., 2012; Shapiro, 2017). This raises questions about the extent to which the digital maps inform people's knowledge and practices. Pam addresses this head-on, stating that as an influence on her choice of home, digital maps "were about 50%….It was going really based on what I found on the map, and then going and actually looking at it." She frames digital maps as a key part of her landed capital acquisition decision-making processes. Later Pam adds that not only did digital maps inform her final choice of home, they also increased the overall range of homes from which she selected, noting that:

> Without digital maps I wouldn't have actually viewed them. I wouldn't have put them on my list….I would have to have a lot of trips up there and travel around I think, just to view. By having the [digital] map, I could say a definite yes or no just by looking.

Pam adds that it was "more sort of StreetView than the map" (like Kelly above) to "look at just the general state of the place…get a feel for it…look at the tax and the crime." However, her account goes beyond getting a sense of the place based on photographic imagery of bins being left out. It also includes a reading of external datasets embedded within the digital map, such as local council tax banding and official Police crime statistics for the postcode—both state legitimated outputs that she implicitly trusts the digital map to report. Here, she looks at the StreetView imagery to gain an initial sense of place and then draws on external data embedded within the digital map to confirm or amend it. In doing so, her account resonates with Dodge's (2018, p. 950) assertion

that "more extensive digital geographies will feed into map-making and changing mapping practices in the next few years." Her account also suggests that the meanings associated with place through the use of a digital map are open to revision and change (contra Power et al., 2012; Thatcher, 2013).

As well as digital maps informing choice of site (where to go), they also inform choice of route. For example, Pete notes that "you can tell if somewhere is run down, a bit rough, the kind of place maybe you wouldn't want to be walking through" by looking at a digital map. He recalls visiting a town he had not been to before and planning to walk "from the train station to the other side of town," adding that when he "looked on StreetView [it] affected [his] decision not to walk through [the town centre at night]…because it's not a brilliant place….' Here, Pete's use of the technology and interpretation of its content resonates with Thatcher's (2013) argument that future pedestrian routing technologies may direct users away from areas that are algorithmically classified as being 'risky,' the difference being that Pete makes this classification subjectively. Here, the sense of place Pete gained through a digital map was steeped in a subjective set of associations and classifications (meanings) that he had stored in memory (like Kelly and Pam above). These memories were based on past experiences and practices of walking through urban space in other areas. In reflecting on the map content and the meanings he applied to it from his memories, Pete noted they informed his decision to choose another route. Thus, digital maps influence the distribution and movement of bodies in space, e.g., where people go and how they get there. However, it is not just material practices that are influenced by digital map use—more abstract experiences of urban space are equally at stake too.

One experience anchored in digital maps use is a sense of security. At times this can be based on using digital maps as simple geolocative allocative resources, to feel secure in knowing where one is located, and in being able to wayfind independently without relying on other people as Paula explains:

> When I go to Manchester for meetings, which is a strange place, I use Google Maps…it lets me feel safe and more confident not having to ask people…[because I have] got a back-up.

Here, the digital map need not be used, but can be ready-at-hand, as a smartphone app and referred to at any time. It provides a sense of independence (of not having to interact with or rely on others) and confidence in being able to oneself if needed. However, this sense of security (independence from relying on others) requires access to a smartphone and web connectivity as stable material arrangements. This latter point is raised by Dave, who explains that being "able to quickly and easily pull a [digital] map of where I am to be really kind of comforting," especially when away from home in a different city, for which he adds that it "gives [him] a sense of security…that [he is not] not really that lost." In this, digital maps not only provide reassurance that he can locate himself and navigate to where he wants to be (cf. Roth et al., 2017), but that they also provide a sense of "where things are in relation to me, how far I am from things." Here, the sense of security provided by digital maps is one reassurance and location—requiring access to digital maps and a device to access them as relevant material resources that inform sense of place.

For others, the sense of security provided by digital maps connected with far deeper-rooted existential sense of ontological security. Claire, for example, uses digital maps when visiting other cities as part of her work for the university. They provide reassurance in locating herself and enable her to make sense of places in advance of going. Claire adds that this means she can adhere to her employers' green impact policies on staff travel expenses by choosing a particular mode of (public) transport. Thus, it places her in a position of 'good employee'—maintaining her continuous narrative of ongoing employment as a stable condition that offers her the ontological security (Giddens, 1991) that life will go on as normal and not be challenged by her getting lost. For this, Claire explains that having access to a digital map means:

> I am more confident using buses in areas I'm not familiar with….I knew the bus stopped near the bus station, but I didn't know where…[so I] got my little iPhone out and got a discreet view of how close I was getting….[It's] good for the university because it means I am less likely to use taxis, which are more expensive, and it is better for green impact….[So] having a digital map gives me the reassurance of knowing I know where I am, or I know how far I am from where I need to be, or if I miss the stop I know how to get to where I want to be.

Together, the above accounts have shown that people trust digital maps and the datasets embedded within them. This relies on understanding the information they provide is indexical and accurate. The accounts also show that choices of site and route and the practice performances tied to them can all (in part at least) be shaped by digital map use. Here, senses of place, personal safety, reassurance (including not having to rely on others), and ontological security (in continuing an ongoing stable narrative) combine as different senses of security that people gain from using digital maps. In this, digital map content is not fully coercive or structuring of action. Rather, people are agentic in making senses of place and gaining senses of security by drawing classifications and associations (meanings) stored in memory traces and applying them to digital map content. However, for urban planning it is important to understand that digital maps and the data embedded within them do serve to mediate the ways in which people use and move around in urban space.

7. Conclusion

This article has shown that digital maps mediate our knowledge and experience of urban space, and senses of security within it, even when not directly used. The article has shown that these senses of security, at times, may be false (maps can be wrong) and are often tied to people having access to relevant materials (e.g., smartphones when on the move). It has also shown that digital map use has altered the ways in which bodies are distributed in urban space in more material ways—ranging from where people choose to live, which jobs they take up, and the travel routes they take and mode of transport selected. In this, people have been shown to be agentic in drawing on memory traces to make sense of place through personal classifications and associations. Here, people trust digital maps to provide veracious representation of urban space. As indexical and continually updated allocative resources, they invest any external dataset incorporated within them (e.g., crime statistics or council tax banding) with the same level of legitimacy. Together, these factors lead the article to an argument that the senses of security provided by digital maps are reshaping the way urban space is experienced and used in several ways. This is important for urban planning, in so far as knowing how people are likely to use and make sense of cities is a central concern. To that end, this article provides two suggestions: (1) that a practice theory based approach is well suited for examining the wants, needs, and desires of people in contemporary cities—and by extension for planning urban space around people's experiences and uses of space that are increasingly mediated by digital technology; and (2) that digitally mediated senses of security should be considered as important aspects in examining the distribution and movement of bodies in space. As such, useful extensions of this article could include looking quantitively at the practices of key groups (e.g., home-buyers at a national level) and the extent to which digital maps have been used and trusted, and how extensively they feature in decisions of which home to buy across the country—and indeed between countries. Another focus could look to examine the competence required to make use of digital maps and evaluate how that might be incorporated into educational programmes. Furthermore, the article's framework could be used to compare the ways in which different digital technologies (not just digital maps) that feature in people's lives mediate their experiences of urban space and their performance of particular practices—notably by taking forward its argument that they do so by influencing people's sense of security.

Conflict of Interests

The author declares no conflict of interests.

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About the Author

Matthew S. Hanchard (PhD) is a Research Associate at the University of Glasgow with a background in map studies, transport studies, audience studies, and data science using NVivo and R. He is currently exploring how computational social science research methodologies can aid film audience development and the social consequences of digital technologies such as smart street furniture on urban life.

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Article

Expert-Amateurs and Smart Citizens: How Digitalization Reconfigures Lima's Water Infrastructure

Fenna Imara Hoefsloot [1,*], Javier Martínez [1], Christine Richter [2] and Karin Pfeffer [1]

[1] Department of Urban and Regional Planning and Geo-Information Management, University of Twente, 7514 AE Enschede, The Netherlands; E-Mails: f.i.hoefsloot@utwente.nl (F.I.H.), j.a.martinez@utwente.nl (J.M.), k.pfeffer@utwente.nl (K.P.)
[2] Fraunhofer Center for International Management and Knowledge Economy IMW, 04109 Leipzig, Germany; E-Mail: christine.richter@imw.fraunhofer.de

* Corresponding author

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Abstract
In Lima, residents are fundamental co-creators of the urban water infrastructure, taking up various roles in the operation, maintenance, and expansion of the water distribution system. As Lima's potable water company presses the transition from decentralized and auto-constructed to centralized and digital, this article explores how the implementation of digital infrastructure reconfigures the role of residents in the water distribution system. Our analysis draws on an ethnographic research approach, using formal and informal interviews, and focus groups in three areas representing Lima's diversity in settlement categories and types of water consumers. By analyzing the digitalization of Lima's water infrastructure through the perspective of its residents, this research contributes to understanding how top-down, digital governance practices mediate the agency and everyday experiences of people living in Southern cities. We observe that the digitalization of the water infrastructure marginalizes the participation of the 'expert-amateur,' a crucial role in the development of urban in the Global South, while providing more space for the 'smart citizen' to engage in infrastructuring. This article concludes that to overcome the perpetual creation of the center and the periphery through digitalization, urban infrastructure management should be sensitive to residents' diverse strategies in managing resources.

Keywords
auto-construction; digitalization; expert-amateurs; Lima; Peru; smart cities; smart citizens; water infrastructure

Issue
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1. Transitioning from Fragmented towards Integrated Infrastructure

This article explores how the water infrastructure of Lima transforms materially and organizationally as SEDAPAL, Lima's potable water and sewerage company, presses the transition from decentralized and auto-constructed to centralized and digital and what this means for the roles of urban residents in the process of infrastructuring. The history of Lima's infrastructural growth is one of auto-construction. In the absence of government service provision in the city-becoming, residents have created fragmented networks of water distribution systems with a large variety in materials, efficiency, and functioning. These auto-constructed systems have different iterations, some are more, and some are less controlled, but in almost all cases, they are communal in nature. As a result, the water infrastructure in Lima is a patchwork of planned as well as auto-constructed infrastructures, only connected by the water that flows through them.

One of the primary objectives of SEDAPAL is to unify these different water distribution systems and create one homogeneous infrastructure that services all of the city's residents. Aside from expanding the water pipes

within the city, SEDAPAL aims to achieve an integrated and centralized infrastructure by implementing digital information technologies. The digital, in this case, refers to the collection of technologies used to generate, distribute, analyze, and use data for infrastructural management (Star & Ruhleder, 1996). This includes data acquisition technologies, such as meters and sensors, and the geo-information systems—digital by nature—used for the management and analysis of water-related data. Under the banner of creating a more efficient and easily controllable network, SEDAPAL has implemented digital information and data acquisition systems, making it possible to monitor the operational and commercial sides of the infrastructure in one web-based geo-information system (SEDAPAL, 2015). These digital infrastructures make the system legible, albeit to various degrees, and facilitate the centralization of Lima's water management (Hoefsloot, Pfeffer, & Richter, 2019).

The implementation of digital infrastructures works towards achieving what Graham and Marvin (2001, p. 73) have called the "modern infrastructure ideal." They argue that the modernist image of fully integrated and standardized infrastructure, as developed in Western countries, has been exported as ideal for infrastructural provision to colonial and post-colonial cities. However, since the 1980s, neo-liberal politics have led to the unbundling of these integrated infrastructures, resulting in unequal service provision where urban elites are connected and urban poor are disconnected. In Graham and Marvin's work, this transition from integrated towards splintered is presented as characteristic of our time. However, Coutard (2008), drawing specifically on case studies in the Global South, argues that many cities have always been unbundled, and their infrastructures are fragmented and segregated. While the normative imaginary of centralized and universal service provision continues to be a powerful tool in shaping infrastructural planning worldwide, Coutard (2008, p. 1818) suggests that in Southern cities, "recent evolution does not involve a passage from an integrated system to an unbundled one, but rather a passage from one more or less unbundled system to another." Bulkeley, McGuirk, and Dowling (2016) argue that to understand the implications of smart city developments for urban residents, research should engage more directly with the material politics on the development of digital infrastructures. This requires opening up to the diverse forms of agency at work in the process of infrastructuring and asking who is included and who benefits from technological transformations (Bulkeley et al., 2016).

Hence, to understand the social implications of these dynamics, we have to unpack how they play out in specific socioeconomic and material structures and reconfigure the script of the infrastructure. The concept of the script (Akrich, 1992) refers to the embedded logic of the socio-material structure that steers the interaction with users (Jelsma, 2006). The script of the infrastructure prescribes roles for users and technology as 'actors' in a play. Yet, the script is continuously rewritten through users who change the system according to their own logic or the implementation of new technologies (Jelsma, 2006). Previous scholarship in smart urbanism has foregrounded how digital infrastructures re-inscribe the governing of flows within the city by integrating physical and information systems spatially and hierarchically (Marvin & Luque-Ayala, 2017); the implications of smart city policies in urban development (Verrest & Pfeffer, 2018); and emphasized how the general rhetoric of the smart city prioritizes an increase in surveillance and efficiency (Kitchin, Maalsen, & McArdle, 2016; Luque-Ayala & Marvin, 2015; Vanolo, 2014). Yet, there is a need to understand how these integrative transformations affect residents' influence, control, and self-determination in urban development (Marvin & Luque-Ayala, 2017). The imaginary of the smart city is so strongly coupled to high-tech innovations and private-public partnerships that the resident is often not considered or simply conceptualized as a 'data provider' (Calzada, 2018; Vanolo, 2016). With sensing applications in mobile devices, homes, vehicles, and city-wide infrastructures, residents are continually producing data that are incorporated into smart city products (Rabari & Storper, 2015). Data is created while residents simply perform their daily routines (Calzada, 2018).

Today, the discourse about the smart city is shifting towards a more resident-centered framework in which people are no longer seen as instrumental to the technological development of the city but as their co-developers (Calzada, 2018). This strongly resonates with the development in Western cities, where urban planning has moved from modernist master plans to smart cities and is now progressively allowing for diverse forms of resident participation in the construction of urban space. Hajer and Dassen (2014) argue that the truly smart city should integrate residents in the process of developing infrastructure. They reason that, with an increasingly educated society, the community is a valuable source of information and energy, and its collective intelligence should be harvested.

Vanolo (2016) describes how the resident, and their role, is imagined differently in various discourses the smart city. Within the neoliberal discourse of the smart city, the 'smart citizen' is a homogeneous category of people who are digitally connected, educated, and willing to participate (Vanolo, 2016). Optimistic about the potential of digital technologies to empower and democratize, it is argued that the smart city amplifies the voice of residents in the planning and construction of urban space (Shelton & Lodato, 2019). Nevertheless, Shelton and Lodato (2019) explain, the smart citizen has to adhere to the confinement of the technocritical and neoliberal political and material practices of the smart city. Only those who can invoke particular forms of expertise tied to policy-making or technological development can participate. Effectively, less privileged residents who do not have this form of professional or institutional cap-

ital are overlooked or excluded (Shelton & Lodato, 2019; Tenney & Sieber, 2016). Hence, 'smart citizenship' is a reductionist and exclusionary category, reserved only for those who are privileged to be documented as citizens of the city and have the education and capital to participate in the digitalized system. However, in Southern cities, also non-registered and non-connected residents have always been active as fundamental co-creators of the city (Button, 2017; Holston, 1991). As builders, managers, and maintenance workers, they have constructed and operated urban infrastructures, living through its many iterations (Simone, 2019). Kuznetsov and Paulos (2010) introduce the character of the 'expert-amateur,' emphasizing the fact that the people who are involved in these community constructions have advanced knowledge about the artifact or system they co-construct. Yet, they do so outside of the professionalized and commercial sphere. The expert-amateur is oftentimes autodidact or has gained their knowledge and skills while learning from peers.

Therefore, mindful of these differences in the positions and capacities that residents can have within urban infrastructure, we ask: How does the digital infrastructure reconfigure the roles within the water distribution system in Lima, now imagined as centralized and digital, rather than decentralized and auto-constructed? By analyzing the digitalization of Lima's water infrastructure through the perspective of its residents, this research contributes to understanding how top-down, digital governance practices mediate the agency and everyday experiences of people living in Southern cities.

We specifically zoom into two technologies implemented in Lima's water infrastructure: the household water meter and the customer contact center. These two technologies are now standard practice in many cities worldwide, yet play a crucial role in the digitalization of the water infrastructure through their production of data. The meter produces numerical data about water consumption within the city. The customer contact center allows SEDAPAL to register textual and visual data about the functioning of the water infrastructure. Due to their relative fine spatial (households rather than water sectors) and temporal scales (monthly for the meters and continuous for the customer contact center), they provide insights into water consumption patterns and operational issues. Most importantly, the meter and the customer contact center function as an interface between the consumer and service provider (Pilo', 2017). By measuring the household water consumption and the registration of the type and location of the complaints submitted by residents, the meter and the customer contact center translate the interaction of Lima's residents with the water infrastructure into data. The data produced by these technologies allow for the registration of problems and water flows that were illegible before their implementation and are, therefore, important in the production and redefinition of relationships within the infrastructure (Kragh-Furbo & Walker, 2018).

2. Methodology

Six months of fieldwork in Lima during 2019 and 2020 form the empirical basis of this article. It is part of a larger research project focusing on the implementation and impacts of digital infrastructure in Lima's water management. This research project employed an iterative ethnographic strategy for data collection and analysis. 25 interviews were conducted with experts in the field, including engineers working for SEDAPAL, academics, and representatives of community and civil society organizations. The interviews varied in structure and focus, depending on the context of the conversation and person interviewed. We then conducted seven focus groups (FG) with residents asking them about how they access water, administer their consumption, and perceive the digitalization of the water infrastructure. Residents from three areas were invited: José Carlos Mariategui, Barrios Altos, and Miraflores. These three areas were selected to represent the city's diversity in socioeconomic development, geography, and degree of formalization (Figure 1). José Carlos Mariategui, situated on the periphery of Lima, has developed mostly during the last two decades through the process of auto-construction, as will be described further below. The majority of José Carlos Mariategui's residents live in conditions of extreme poverty. Barrios Altos, the 'high neighborhoods,' is one of the oldest areas of Lima. Lending its name from the fact that it is situated on a small hill and thus higher than the main square of the city, the neighborhoods historically developed as housing for the non-noble families of the early colony. Although it has gone through many different phases in the past, today, it is a middle and low-income neighborhood. The third district where we conducted our research, Miraflores, is the city's main upper-class residential district and forms the center for Lima's tourism industry. Modern high-rise apartment complexes characterize it.

This research specifically focused on these three areas to compare the different roles of residents in the water infrastructure across urban classes and living conditions. Previous research has analyzed issues related to water infrastructure, water access, and water use amongst the urban poor in Lima and Latin America (Allen et al., 2017; Brown & Pena, 2016; Fernández-Maldonado, 2008). Yet, few studies have included the practices and perspectives of the urban middle class and elite in discussing the process of infrastructuring. The participants in the focus groups thus represent users of auto-constructed infrastructures and digitalized and integrated infrastructures. Since the focus groups attracted more older adults than youth, we organized an additional focus group with Limeños aged 18–30.

Additionally, we organized two meetings with experts in the field to discuss the technological development of the water infrastructure and generate knowledge about the possible futures for Lima's water distribution system. The first meeting included experts from dif-

Figure 1. Areal and street views of the three research areas. Source: Google Earth and Google Maps.

ferent strands of government, academia, and civil society groups. The second expert meeting was with researchers and engineers of SEDAPAL. The focus groups and expert meetings lasted between one and two-and-a-half hours and were recorded and transcribed.

We used the analogy of the 'script' (Akrich, 1992) to analyze how the design of the infrastructure defines the roles of, and interactions amongst, residents and technology within the system as it transitions from decentralized and auto-constructed to centralized and digital. Jelsma (2006) conceptualizes the script as a prescriptive force that steers the behavior of a technology's users in a certain direction that matches its inscribed logic and redistributes roles, responsibilities, and power within the socio-technical network. Thus, the script of the infrastructure shapes the role of a person within the system and encourages certain 'desirable' actions while discouraging 'undesirable' use (Jelsma, 2006). The infrastructural script can be moralizing in the sense that it steers towards practices that align with its embedded normative framework. By making the 'better' option more convenient, residents are nudged towards conforming with the 'integrated infrastructural ideal' (Koop, van Dorssen, & Brouwer, 2019). Nevertheless, this relationship is bi-directional. The users of the system, in this case, the residents of Lima, might envision different roles for themselves and re-inscribe the infrastructure through their actions and based on their experience and situated knowledge (Akrich, 1992; Rose et al., 2018).

Using Atlas.ti™, we conducted a thematic analysis of the focus group transcripts as well as the individual interviews, coding for different roles within the infrastructural development (planning, construction, operation, maintenance, and replacement) as the main themes and paying specific attention to narratives that explained people's perception of, and attitude towards, the implementation and use of digital infrastructures for the administration of water consumption. Three main themes emerged out of the analysis process: (i) How people have auto-constructed their domestic and communal water infrastructures, (ii) how the meter and the customer contact center changes the script for the operation of the infrastructure, and (iii) how the meter and customer contact center redefine the roles of, and interaction between, SEDAPAL and Lima's water consumers based on embedded norms. These three themes correspond with the three result Sections 3.1, 3.2, and 3.3. Throughout the text, translated quotes from the verbatim transcripts illustrate the residents' experiences and interactions with the digital infrastructure and complement our empirical data with findings from the literature.

3. Results

3.1. Lima Built by Expert-Amateurs: Residents as Engineers, Constructors, and Maintainers

Like other Latin American metropoles, Lima has grown mainly through the building of dwellings, neighborhoods, and infrastructure by its residents (Amin, 2014; Caldeira, 2017; Fernández-Maldonado, 2008; Holston, 2009). In this section, we analyze the script of the auto-constructed infrastructure and illustrate how, depending on their geographical location and socioeconomic context, residents have shaped the water distribution system to fit their needs and inscribed according to their own logic, with SEDAPAL often only having very little formal influence as the provider of water to the central dis-

tribution point or vendor of water to the trucks that serve the area.

Lima's urban expansion was particularly fast from the 1950s to the 1970s, during which internal migration towards the city was particularly large (Ioris, 2012). Due to the lack of available housing to accommodate the growing number of residents in Lima, people started to organize themselves, occupying barren lands on the fringe of the city, building their first settlements, and constructing primary infrastructure such as water and electricity networks (Ioris, 2012). This form of auto-constructed urbanization continues today. With every new generation, the peripheral edge of the city has moved further outwards and upwards, stretching over the hills surrounding the city. In general, Lima's most impoverished families live in the farthest and most precarious dwellings.

Although this form of urban and infrastructural development is especially prevalent in the newly urbanized areas in the city's periphery, auto-construction also exists in the heart of the city and its most affluent neighborhoods. As Caldeira (2017) argues, the 'urban periphery' is not by definition physically located on the urban fringes. Peripheral urbanization and auto-construction can exist in all geographical locations. Holston (1991) describes auto-construction as the process in which people construct neighborhoods under precarious circumstances, physically, legally, and socially, and slowly consolidate their right to the city through the formalization of their dwellings. The auto-construction of housing and infrastructure is impactful; not only because it is the construction of something out of nothing, but because it is a process in which settlements gradually transform into urban districts and squatters into citizens (Holston, 1991).

It is estimated that about 60% of Lima's urban area is auto-constructed (Metzger, Gluski, Robert, & Sierra, 2015). Today, many of the districts that have been constructed by residents in the 20th century are fully consolidated and integrated into the urban fabric (Fernández-Maldonado, 2008). Many more recently inhabited areas are still in the midst of this process. These auto-constructing communities, often living in partial informality, thus form a driving force in the urbanization of Lima, including the expansion of its water distribution system. Residents continue to play an essential role in the development, operation, and maintenance of the water infrastructure. However, it is a fine line between appreciating the resourcefulness and creativity in auto-construction without romanticizing the retreat of the state in service provision (Jiménez, 2014). In contrast to self-built neighborhoods, co-housing, and participatory planning practices in the global North, auto-construction in urban centers in the Global South is often a symptom of poverty and born out of necessity due to the lack of basic services provided by the state (Caldeira, 2017).

In peripheral neighborhoods, residents invest their labor and time in laying pipes, building reservoirs, and designing a system of pumps, tanks, and hoses to distribute water to the different homes in the neighborhood. In the central areas of Lima, such as Barrios Altos, where piped infrastructure is often physically close, but individual households or *quintas* (traditional courtyards with multi-household dwellings) are not yet connected, people construct clandestine connections to the primary grid or the networks of their neighbors. As a result, one Barrios Altos resident explained that the system is often overburdened:

> We do not respect the laws, we do not comply….While I pay, there are five neighbors who pay nothing, and now I have to bathe at 6 pm or at 5 pm, if I want to bathe at 10 or 11, I can't, I don't get it. In Barrios Altos, I am next to the river or near…and I cannot take a bath because it does not reach me, because from the pipe that comes five people are pulling [water]. (FG, Barrios Altos, 12 February 2020).

On the city's edge, in José Carlos Mariategui, geography plays a significant role in the types of systems that have been developed. The steepness of the hills and the quality of the roads that connect the area determine whether or not trucks carrying water (*cisternas*) can access the residents. In the most distant areas, where the *cisternas* cannot reach, residents generally construct a communal reservoir in a lower-laying part of the area. From this reservoir, the water is pumped through a network of hoses that service the different households. This system requires frequent maintenance and repair as the pump and the hoses are vulnerable to breakdown. Even for those who do live along the route of the *cisternas*, access to water remains a challenge. Residents are never entirely certain when the truck will pass their homes and if it will stop. To mitigate this, many residents have invested in constructing water reservoirs that, when filled, will last them for a couple of days.

Additionally, community boards coordinate the water management and administration within their areas (see Figure 2) and work towards formalizing the water distribution system in cooperation with SEDAPAL. The success of these practices varies and depends largely on the community's capacity to self-organize and work together. On a smaller scale, and in communities that are serviced by SEDAPAL, residents tweak the system: households install reservoirs on their roofs to guarantee a continuous supply of water despite cuts, they implement filters so they can drink water from the tap, or even build connections between the sink and the toilet to ensure that dishwater can be re-used.

Analyzing the script of the auto-constructed infrastructure, we find that residents play a crucial role in all phases of the infrastructural life cycle. The distinction between the service provider and the consumers is blurred. Residents, as 'expert-amateurs,' play a significant role in continuously expanding, improving, and maintaining the infrastructure (Caldeira, 2017;

Collection of payments for water for the month of January

Expires on 18–02–2020
S/. 701.70 + 1.00 (agent) S/58.60 pp

Paid 17/02

Paid 15/02
Paid 17/02

Missing Payment
Month overdue:

S/. 55.30 pp

Paid 17/02
Paid 17/02
Paid 14/02

2 months
S/ 99.90

Do not forget that water is a priority today

Paid 17/02

We are in summer.

We are in cuts

Figure 2. Poster on the communal wall in quinta, keeping track of the payments for the water bills. At the time, 58.60 soles corresponded to €16 or $17.3. Source: Liliana Miranda Sara. Translation by the authors.

Kuznetsov & Paulos, 2010). They take up the role of engineer, builder, and manager in one, thereby blurring the distinction between service provider and consumer, and adjusting the infrastructure to align with their needs and practices. Contrary to the formal infrastructural planning in Lima, which is a highly bureaucratic process, the auto-constructed infrastructure can respond quickly to the changing needs of residents. Within the auto-constructed infrastructure, the demarcations between the different stages of the infrastructural cycle are less clear, continually moving between planning, construction, operation, and maintenance. Nonetheless, aside from calls to residents to save water and consume responsibly, SEDAPAL's master plans often do not acknowledge their labor and knowledge in shaping the water distribution system. Although some of these constructions have been in place for decades, the work of residents is almost without exception characterized as tinkering around in the margins. The systems they construct are seen as provisional, a placeholder for when SEDAPAL integrates these areas in their centralized and digitalized infrastructure.

3.2. How Digitalization Redistributes Roles within the Operation of Lima's Water Infrastructure

As the infrastructure transitions from decentralized and auto-constructed to centralized and digital, we see that tasks that previously were the domain of the residents are now shifted towards SEDAPAL as the main service provider. In this section, we analyze how the introduction of the water meter and the customer contact center have (i) facilitated the centralization of the operation of the water infrastructure and (ii) re-inscribed the roles of residents within the operation of the water distribution system.

Operationally, the meter and customer contact center are efficient tools for monitoring the consumption behavior of users and the functioning of Lima's water infrastructure right from the central water treatment plant, La Atarjea. The implementation of the meter thus helps to centralize the control and supervision of the infrastructure, bringing Lima's water distribution network one step closer to the 'integrated infrastructure ideal.' The meter enables the enumeration of the water

consumed on a small scale and the inclusion of this data in the GIS-based systems used for the supervision and operation of the water distribution system. The type of meter implemented varies depending on the technology available at the time of installation, the width of the pipe, and the pressure of the flow. As a result, some household consumption meters in Lima need to be read manually, while others can potentially be read at a distance through electronic pulse emitters or radio frequencies (INACAL, 2020). In December 2019, 95% of the residential connections to the piped water infrastructure were metered. However, the meter coverage ranges from 41% in the least covered district to near full coverage in other districts (SEDAPAL, 2019). Households with an unmetered are charged a flat rate based on the average hours of water supply, or communities share a water bill and self-manage their payment. Upon the meter's arrival, households receive an individual bill reflecting the meter's measurement of the amount of water consumed that month. Additionally, through the meters, SEDAPAL can detect leakages and clandestine connections much easier, which leads to a reduction in the percentage of non-revenue water in their system.

Likewise, the textual and visual data generated through the customer contact center help SEDAPAL monitor the infrastructure through residents' reports, effectively providing feedback on the system's functioning. Initially, SEPAPAL hosted the call center itself, to which users could report issues with the infrastructure via phone. Today, the contact center has been outsourced and expanded, integrating various media such as e-mail, social media (Facebook, Twitter, and Instagram), a chatbot, video calls, and photo sharing into one service. The calls and the operator's movements on-screen are recorded and compiled in a file linked to the caller's customer number and, therefore, disclosing personal information such as their address and geo-location. This allows the operator to return to the conversation at any moment later in time. With the operators recording incidences and passing on this information to the relevant directories, SEDAPAL has a continuous flow of digital information coming in, reporting on the quality of its service.

In both cases, we see that the data provide information about the operation of the infrastructure on multiple levels. The data from the meter, translated into a water bill, offers residents information about their consumption patterns and can serve as a gauge to keep track of changes or failures in the system. In a number of cases, residents had received extremely high bills due to undetected ruptures or leakages in the pipes. Talking about this issue, one participant explained:

> We have had serious problems because a receipt for 6,000 has arrived! 6,000 as if we lived three, two more buildings or we would have a large pool….Of course, you pay first and then you reclaim [the money]. But we found the flaw. It was at the entrance. (FG, Miraflores, 23 January 2020).

Additionally, the spatially fine-grained (household scale) and monthly updated data from the household consumption meters provide information to SEDAPAL on the functioning of its water distribution system. Similarly, the reports continuously coming in through the customer contact center offer information on the function of the water infrastructure through the eyes of the residents. There is, of course, a bias in the self-reporting of residents as they will more likely report issues that affect them negatively rather than positively, either in their access to water or financially. Yet, through the customer contact center, SEDAPAL can capture issues that would otherwise go unreported.

At the operational level, the imperative of achieving a fully integrated infrastructure, and hence, the implementation of digital infrastructure to supervise and control the water distribution system from a central point, has been a powerful driver in the reconfiguration of information flows and relationships within the system. For residents, the digital infrastructure signifies a transition in the roles they have within the system. The implementation of the water meter shifts the administration of the water bills from the residents to SEDAPAL. From constructors, engineers, and bookkeepers, residents transition into the role of 'smart citizens' and form a critical link in the provision of data. Specifically, they play a crucial role in constructing new information flows, both to SEDAPAL and their communities and households. While the meters gather background information about household consumption, rendering residents into passive data providers, the customer contact center relies on the active involvement of consumers in reporting the malfunctioning of the system. As a result, in the script of the digitalized infrastructure, residents take up different roles than in the auto-constructed infrastructure. Rather than physically constructing or operating the infrastructure, they re-inscribe it through their passive or active production of data.

3.3. How Digitalization Reconfigures Residents According to Its Embedded Normative Framework

In this section, we analyze how the re-scription from auto-constructed to digital infrastructure is tied to concerns about the integrity of the technology and how the meter and customer contact center prescribe residents the roles of 'smart citizens' and 'responsible users' rather than auto-constructors based on the infrastructure's embedded norms.

In conversations with SEDAPAL, the digital information infrastructure represents the modernization of the distribution system and overall 'progress.' Modernization, in this case, signifies a clear relationship between the residents as customers and SEDAPAL as sole service-provider. Particularly in the *quintas* of Barrios Altos, the residents welcomed this transition. From our analysis, it emerged that the administration of the water consumption amongst these communities

was often paired with stress and conflict, either due to the fact that not all neighbors would pay their respective share in time or because people would construct clandestine connections to avoid payment. Whereas previously, it was necessary for several households to make collective agreements about payment of the water bill, the meter individualizes this process and decreases one's dependency on neighbors. One participant alluded to the way the meter offers residents a certain degree of protection from their neighbors. They explained that the meter provides transparency concerning who is paying for the water, and therefore makes it visible who has constructed a clandestine connection and is 'stealing' the water from their neighbors.

While this change is welcomed by many, the implementation of the meter is also regarded with suspicion by others. The residents expressed uncertainty about interpreting the data generated by the meter and its accuracy in reflecting the households' consumption. For example, it was not understood how it was possible that after the implementation of the meter, their water bill had gone up. Or, in Miraflores, why their consumption was registered as so much higher than in other areas. During FGs, participants hypothesized that these issues could be explained by the quality of the meters installed:

> You see the meters that SEDAPAL puts, the air passes and [the meter] rotates and should not rotate for the air, only when the liquid passes (FG, Barrios Altos, 12 December 2019)

Or by SEDAPAL taking advantage of the opacity in the data flows to their benefit:

> Participant 1: It may also be that they are inflating the consumption.
>
> Participant 2: I wouldn't be surprised at all. (FG, Miraflores, 23 January 2020).

As a result of this lack of trust in the integrity of the technology and SEDAPAL, in Miraflores, the overwhelmingly highly educated crowd in the focus group discussed the possibility of partnering with accredited laboratories to measure the accuracy of the meter and check the water quality. In discussing their options, the importance of working together with an official notary and working with certified material was emphasized to avoid all possibilities of not being taken seriously. Similar concerns were voiced, and possibilities for actions discussed in Barrios Altos and José Carlos Mariategui. However, contrary to the specialist approach discussed by the residents in Miraflores, the envisioned options of residents in Barrios Altos and José Carlos Mariategui were to file complaints with SEDAPAL directly via the customer contact center or on social media, a process which was described as tedious and often dead-ended:

> Participant 1: I think you can report what's happening on social media, right?
>
> Participant 2: Yes, but they never answer you, one calls for any accident, your pipe breaks, and they never answer. It is a bit difficult to talk to them.
>
> Participant 3: Practically, they have [the costumer contact center] as a screen. (FG, José Carlos Mariategui, 11 December 2019)

Thus, although designed as an instrument for enhancing the service provision to the users and improving the residents' relationship with SEDAPAL, in conversations, residents frequently shared their frustrations with us regarding the customer contact center. Residents explained they were put on hold for a long time and that when they managed to get through did not receive the help they expected. On the other hand, officials of SEDAPAL said that there are often inconsistencies in user reports, and people try to twist the truth for it to suit them better.

This highlights the contradictions in people's responses to the implementation of digital infrastructures and the roles they play in their becoming. The (digital) technologies, and by extension the digital data they produce, change the script of the system by creating new information flows between the infrastructure and SEDAPAL, as well as between the residents and their water consumption. This suggests an increase in efficiency and transparency: Two much-needed properties for the administration of basic services (Ioris, 2016; Martinez, Pfeffer, & van Dijk, 2011). Additionally, since users with a meter see the changes in their consumption pattern directly reflected in the monthly water bill, the presence of the meter incentivizes responsible water consumption (Brown & Pena, 2016). However, given residents' general skepticism towards the integrity and capacity of SEDAPAL, the meter represents the presence of an institution that is mistrusted, and it is widely linked to stories of malfunctioning.

We notice a difference in the ways that residents, coming from various socioeconomic backgrounds, navigate these contradictions. As part of the residents embrace the implementation of the meters, others have refused to them installed in their neighborhoods or have taken them out of the infrastructure upon installation. This is closely tied to normative discussions about what it means to be a responsible consumer of water. While skepticism towards SEDAPAL and the water meters is widespread, residents who refused to have meters installed are often questioned for their motives. It was stated by fellow residents and SEDAPAL alike that their unacceptance of the water meter and unwillingness to share information came from a wish to maintain clandestine connections rather than concerns about the integrity of the technology. The distrust towards these communities is reflected in the policies of SEDAPAL, which only provides water 24/7 to infras-

tructural sectors with meters installed. The other sectors are rationed and receive water for limited hours per day since it is assumed that non-metered residents will consume irresponsibly.

Thus, the meter and the customer contact center, as pivotal objects in the digitalization of Lima's water infrastructure, reconfigure the role of residents within the system, not only operationally, but also morally. The meter contributes to the independence of households in their administration of water consumption and can serve as a tool for people to become 'responsible water consumers.' The people who opt out of this transition are regarded as irresponsible consumers and punished for not following the script. Interestingly, the digitalization of the infrastructure does not lead to a similar transition in residents' perception of SEDAPAL and the state at large. The meter does not improve the public image of the SEDAPAL by increasing efficiency and transparency. In practice, quite the opposite has occurred. By its association with SEDAPAL, the meter is perceived and experienced as counterfactual and part of a fraudulent infrastructural assemblage.

4. Agency and Self-Determination within Digitalized Infrastructure

As Simone (2019) writes, urban residents inhabit the process of urbanization, rather than the place. This is specifically true for Lima's working-class residents who live through the different iterations of the script of the water infrastructure, which requires different tasks, relationships, and skills from them each time. Focusing on the work that is necessary to construct and operate infrastructure illustrates how this transition does not take place automatically, nor is it always considered to be an improvement. The ways that residents relate to these changes are multiple, as are their strategies to navigate them.

This research has analyzed how the digitalization of the infrastructure alters the script of the system and redistributes tasks, roles, and responsibilities within the infrastructure. The construction and administration of the water infrastructure have increasingly become a governmental rather than a communal effort, reflecting the centralization of the infrastructural system. In the script of the auto-constructed infrastructure, people's roles are best conceptualized as 'expert-amateurs' (Kuznetsov & Paulos, 2010). The qualification of 'expert' is important in this case since the residents have advanced tacit knowledge about the needs of the community and the design, operation, and administration of the water distribution systems they have developed. As auto-constructed systems are formalized and augmented with digitalized infrastructure, residents transition from these roles into various types of data providers, i.e., smart citizens.

The conceptualization of residents' roles as 'smart citizens' is a useful heuristic to think through the exclusionary ways in which the position of people within the infrastructure changes (Calzada, 2018; Vanolo, 2016). When only digitally enabled participation, be it active or passive, is considered valuable, the work and engagement of non-digital residents remain hidden (Tenney & Sieber, 2016). Our analysis shows that despite the normative push of the infrastructure to mold people into 'responsible consumers' or 'smart citizens,' residents find different ways to exercise their agency. This includes opting out of the system, providing information in the shape of data, questioning the workings of the (digital) infrastructure, and critically engaging with SEDAPAL's policies through protests, marches, and public debate. Residents' practices often go against the logic of the integrated infrastructure. They 'disobey' the normative script, sometimes leading to tensions while doing so (Akrich, 1992; Jelsma, 2006).

Nonetheless, the skills needed to exercise agency in the new script are drastically different from the previous forms of the infrastructure. Within the digitalized system, an understanding of (digital) technology and (data) policy becomes more important than constructing expertise or communal organization skills. The digitalization reconfigures the agency of the residents around the expertise of the 'smart citizen,' and, as such, prescribes who has the capacity to act (Pilo', 2017; Shelton & Lodato, 2019). We see this illustrated in the different strategies employed by the residents in Barrios Altos and Miraflores to verify the measurements of the water meter. For non-digital residents, the digital infrastructure can be exclusionary and opaque, whereas these residents were considered experts within the auto-constructed infrastructure. As such, the digitalization of the infrastructure has implications for the self-determination and agency of Lima's residents. Explicitly considering the underlying socioeconomic inequalities in Lima, attention should be paid to developing a system that fosters the participation of all residents and avoids the peripheralization based on knowledge asymmetry (Rabari & Storper, 2015).

It is essential to consider the differences between the digitalization trajectory in formalized infrastructures and cities, compared to auto-constructed spaces. Particularly, as stressed by Vanolo (2016), smart cities are not built on empty land, and a variation in starting points lead to differences in the degrees of residents' participation that emerge. This is not only relevant when comparing various neighborhoods within the city of Lima but also when we conceptualize the influence of digital infrastructures between cities in the North and the South. The differences between residents with metered connections in Miraflores and Barrios Altos show how digitalization does not create homogeneous 'smart citizens' in Lima. Depending on the connections and skills of residents, 'smart citizens' can be integrated or excluded by the digital infrastructure. Similarly, just as the 'smart citizen' should not be considered as either a passive data point or an engaged co-developer (Vanolo, 2016), the 'expert amateurs' are at once marginalized and active-

ly re-inscribing the infrastructure in their neighborhoods or households.

Therefore, the case of Lima shows how thinking about integration and unbundling (Graham & Marvin, 2001) in a successive manner is not useful in the context of Lima, as both processes are happening at the same time. The digital infrastructure has effectively led to an increase in the centralization and integration of the water infrastructure and led to better service provision for citizens who are formally connected. Digital infrastructures are a useful tool in the operation of the water distribution system, provide the opportunity for people to voice their critique via the customer contact center, and cater to the individual household rather than the community. Nevertheless, simultaneously, the digitalization of the infrastructure increases the differentiation in terms of influence and agency and further disenfranchise people and places with little material and socioeconomic connections. While auto-construction continues to be an important form of infrastructural development in Lima, the changes in the infrastructural script hamper people from finding innovative ways to construct and manage water systems according to their own logic, a characteristic of auto-constructed systems which has advanced service provision in areas that are not (yet) serviced by SEDAPAL. As residents are required to switch roles and adapt their capacities to what is considered desirable within the integrated infrastructure, digitalization can further marginalize people and neighborhoods in particular life situations (Caldeira, 2017; Malgieri & Niklas, 2020).

5. The Peripheralization of the Non-Digital

As the smart city and its technologies unfold over the world, it is important to consider the integrity of the digital infrastructures that are called into being. This makes us think about what infrastructures are required to foster connection and inclusion in the margins. Our analysis of how digital infrastructures change the script of the water distribution system has shown how digitalization is not only a matter of efficiency but also leads to the reconfiguration and moralization of the position of diverse actors within the infrastructural system. Digitalization, as a result of the further transformation of auto-constructed to digital infrastructure, contributes to the further peripheralization of the non-digital city, and the non-digital resident as an exceptional category, outside of modern society. The role of the expert-amateur in the auto-constructed infrastructure becomes the 'absent citizen' (Shelton & Lodato, 2019) in the smart city. The acknowledgment of heterogeneity and differentiation can not only attune policies towards the particularities of implementing digital infrastructures in a Southern context (Coutard, 2008) but also make aware of how these transitions shift the roles of residents within the system. To overcome the perpetual creation of the center and the periphery through digitalization, urban water management should be sensitive to residents' innovative ways of getting access to water and managing resources within their households and communities. Future research on smart cities can take inspiration from the expert-amateurs in working towards technological and urban development that cultivates the self-determination of residents and ownership over the (digital) infrastructures created.

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Conflict of Interests

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About the Authors

Fenna Imara Hoefsloot is a PhD Candidate at the Department of Urban and Regional Planning and Geo-information Management of the Faculty of Geo-information Science and Earth Observation (ITC) at the University of Twente. In her doctoral research, she adopts a relational approach to urban infrastructure and critically questions what digital information technology can and cannot do and who is and is not included in the digital representation of the city.

Javier Martínez is Associate Professor in the Department of Urban and Regional Planning and Geo-Information Management within the Faculty of Geo-Information Science and Earth Observation (ITC), University of Twente, the Netherlands. His research, publications, and teaching experience are focused on the application of GIS, mixed methods and indicators for policy-making, urban poverty, community well-being, quality-of-life, and intra-urban inequalities.

Christine Richter is Senior Research Fellow in the Innovation Acceptance Unit at the Fraunhofer Center for International Management and Knowledge Economy IMW, Leipzig, Germany. In her research, she combines insights from Science and Technology Studies (STS) and Human Geography. Past research specifically analyzed the use of geo-data infrastructures and related digitalization processes in urban development and land rights governance.

Karin Pfeffer is a Geographer and holds a Chair in Infrastructuring Urban Futures at the Urban and Regional Planning and Geo-Information Management department at the Faculty of Geo-Information Science and Earth Observation. Her research focuses on the use of geographic information technologies for investigating critical urban issues such as deprived settlements, access to infrastructure, and sustainable urban development, and how research can engage with the development of new urban planning practices and tools.

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Article

City-Life No More? Young Adults' Disrupted Urban Experiences and Their Digital Mediation under Covid-19

Katja Kaufmann [1,2,*], Christoph Straganz [1] and Tabea Bork-Hüffer [1]

[1] Department of Geography, University of Innsbruck, 6020 Innsbruck, Austria; E-Mails: katja.kaufmann@uibk.ac.at (K.K.), christoph.straganz@student.uibk.ac.at (C.S.), tabea.bork-hueffer@uibk.ac.at (T.B.-H.)
[2] Institute for Comparative Media and Communication Studies, 1010 Vienna, Austria

* Corresponding author

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Abstract
The Covid-19 pandemic temporarily, yet significantly, reshuffled the position, functions and (mediated) constructions of cities and urban places. The national lockdown, implemented by Austria on 16 March 2020, turned cities overnight from centres of hybrid cultural, economic, social, political life and power to places where urban life(styles) were put on hold. This article begins by presenting first key results of a longitudinal study with young adults studying in educational institutions in the state of Tyrol through the harshest country-wide lockdown measures and their gradual withdrawal. We analyse how participants coped with the disruption of their urban lives and lifestyles and the strategies they employed to compensate. We highlight three main insights. First, participants who had originally migrated to the city from their (often rural) hometowns largely returned to join their families. From there, no longer being an object of physical experience, the city became a digitally imagined, constructed and communicated place, reiterating public discourses that condemned the city as a place where lockdown measures were breached, and the virus spread unchecked. Second, where possible and adapted to the affordances of digital media, students shifted their previous lifestyles to digital space as well as created innovative ways of socialising digitally—thus producing alternative digital forms of urban lifestyles and digitally-mediated urban experiences. Third, during the lockdown period, the importance, use intensity as well as a variety of digital media peaked tremendously. This trend, however, was short-lived as yearned-for offline sociability largely returned to the city once measures were relaxed, leaving those in rural homes detached from their urban peers.

Keywords
Austria; digitally-mediated city; mobile youth culture; pandemic; urban experiences; urban ills; urban imaginaries; urban lifestyles; urban pathology; young people

Issue
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1. Introduction

The Covid-19 pandemic struck unprepared global societies in 2020 and, within weeks, it "profoundly transformed the familial spaces of home, modes of living, and the geographies of everyday lives" (Rose-Redwood et al., 2020, p. 99). In the (social) media discourses accompanying the pandemic, the city is framed in contrasting ways: Visuals either show the city as deserted space, bereft of all that makes it liveable or as urban public place filled with (often young) people ignoring social distancing regulations, signalling an indifference to social others in the city. Hence, in the public discourse, the pandemic shifted the position of the city from a place where life is happening to a place decried for its population numbers and density, for people breaching regulations that are intended to contain the virus and to, overall, a place that potentially reinforces virus transmission. During the Covid-19 pandemic, mediated discourses and imaginaries of cities emerged, which remind us, as urban scholars, of con-

structions of the city as urban ill that had prominently been produced, particularly by sociologists, from the 19th century onward (see Hubbard, 2006).

This article presents results of the first two phases of an on-going longitudinal study that accompanied students enrolled in universities in the Austrian city of Innsbruck in the province of Tyrol, throughout the pandemic and during the state's and country's far-reaching lockdown measures and their gradual withdrawal in spring 2020. Innsbruck, the provincial capital and one of the university towns of Austria, has a population of 133,206 (as of January 2020; Landeshauptstadt Innsbruck, 2020) and is located in the scenic Alps in the West of the country. Some 35,000 students are enrolled in the city's higher education institutions (Austrian Agency for International Cooperation in Education and Research, 2017). During the pandemic, Tyrol involuntarily rose to fame when some of its popular ski resorts, among them most prominently the resort of Ischgl, were identified as early hotspots of the Covid-19 spreading in spring 2020 across Austria and Europe. In face of the devastating pandemic events in Italy, just across the Southern border of Tyrol, the Austrian Government decreed a national lockdown as well as ordered an even stricter quarantine for the heavily affected province of Tyrol. Spaces of public life were shut down, tourists fled the resorts and the province as such, and students lost their jobs in tourism and gastronomy. Deprived of their urban social lives and facing a deeply unsettling situation, many young adults, too, left the city to return to their parents' homes or moved in with friends and partners to avoid social isolation. The quarantine for Tyrol was gradually lifted in April and also on a national level, a gradual withdrawal of measures started in mid-April ("100 Tage Corona," 2020).

This health crisis and the resultant societal crisis had been unprecedented for the young adults in particular but also the country as a whole in decades. Thus, the events unfolding in Austria, and particularly in Tyrol, with its provincial capital and single university town of Innsbruck, gave us a unique opportunity to research the agency and strategies of young adults in such a fundamental crisis. While the lives of young people in the Global North such as university students are often thriving on their digital connections in the form of a mobile youth culture (Vanden Abeele, 2016), the pandemic situation proved to be ambivalent for the young adults: It was both a cause for creative innovation in making up for their urban student lives but also an insufficient substitute of these lives, a time of social distancing and of overwhelming connectivity keeping up with online learning and sociability.

Against this background, the article reflects on the following question: How are young adults coping with the disruption of their urban lives and lifestyles and what strategies do they employ to compensate for it? The results shed light on shifted, now dominantly digitally-mediated discourses and imaginaries of the city as well as attempts, successes and pitfalls of digital mediation of urban experiences and activities. Through a qualitative and longitudinal approach that accompanied young adults through the phases of the (first) lockdown and its gradual withdrawal, we seek to reveal the immediate effects of the pandemic on university students' disrupted urban lifestyles and their digital mediation under Covid-19.

2. The Digitally-Mediated and Imagined City

In the last two decades geographers, urban planners, media and communication scholars, computer scientists and sociologists have increasingly turned to analysing a variety of foci related to the digital mediation of the city (Bauriedl & Strüver, 2018; Georgiou, 2011; Leurs & Georgiou, 2016; Rose, 2017; Willems, 2019). One of these foci is the mediation of everyday urban life and practices through ubiquitous media in the city and urban spaces (see Bork-Hüffer, 2016; Leurs, 2014). This work is particularly engaging with people's everyday mediated practices and experiences of the city. In the context of his work on Chinese cyber-urbanism, Marolt (2014, p. 3) claims that "all online activities by urban Internet users…are at the same time inherently urban and are augmenting traditional understandings of urban space in the sense that the bodies and minds of the people involved are inhabiting and performing urban space." Although we do not agree to the body/mind dichotomy implied in this quote, we do share the idea of the conflation of digital realms to the extent that digital and physical urban spaces can no longer be separated (see Kitchin & Dodge, 2011; Sumartojo, Pink, Lupton, & LaBond, 2016). Rather, they must be regarded as "interlinked and entangled socio-material-technological spaces" (Bork-Hüffer, Mahlknecht, & Kaufmann, 2020, p. 1). Such spaces are not only imprinted by mobilities of data, goods, people and more-than-human materialities but as well by cognitive and imaginary mobilities (Bork-Hüffer, 2016; Cresswell, 2010; Lemos, 2008; Merriman, 2014; Sheller & Urry, 2006). The latter do not require physical presence but are based on 'connected presence' (Licoppe, 2004) that enables the co-experience of place through digital means from a distance or 'spatial presence' (Croitoru, Wayant, Crooks, Radzikowski, & Stefanidis, 2015) encompassing the cognitive-psychological relation to place without physically-materially being in those places. Referring to young people's online sociability, Thulin, Vilhelmson, and Schwanen (2020, p. 167) speak of "absent friends," where friendship activities "such as making and updating plans, exchanging and discussing thoughts and experiences, hanging out in groups, confirming feelings, sharing and keeping track of vital events and happenings in each other's lives" are performed online.

Mobile media and mobile communication have further changed everyday practices in urban spaces. Their "anytime, anyplace connectivity" (Vanden Abeele,

De Wolf, & Ling, 2018, p. 6) affords individuals a 'micro-coordination' (Ling & Lai, 2016; Ling & Yttri, 2002) of their social interactions, i.e., the "fine-grained instrumental coordination of everyday life" (Ling & Lai, 2016, p. 836) on mobile devices while being on the move. The locatability of mobile media devices via GPS also makes it possible for users to engage with places in novel ways in the form of location-based services and spatial media that open up new layers of meaning (Gazzard, 2011; Leszczynski, 2015). For young adults who leave their hometowns, the connectivity of their mobile devices enables them to stay in touch with families and friends despite the physical separation, allowing them "to move geographically from the home and yet remain connected, tethered to a sense of home as an emotional and psychological space of belonging" (Hjorth, 2012, p. 142). On mobile devices, home thus becomes "perpetually experienced—as both lived and imagined—while physically away" (Hjorth, 2012, p. 142). The relief to be able to stay connected to their families back home, at least via smartphones, has been noted to be important to people in crises (see e.g., Kaufmann, 2018).

Yet, the city is not only a stage and reference point for digitally-mediated practices. It is also a contested and desired object of urban imaginaries that goes beyond the physical and corporeal experience. With the increasing proliferation of digital media technologies, social and mobile media "contribute to an understanding of place as not only geographic and physical but also as evoking cartographies of the imaginary, emotional, mnemonic, and psychological" (Hjorth, 2012, p. 140), thus co-producing and amplifying the omnipresent discourses surrounding cities–as well as complicating our relation to the city (see also Leurs & Georgiou, 2016, p. 3694). Here, the city becomes a "space of imagination" (Leurs & Georgiou, 2016, p. 3697) that leaves room for "making sense of the self and the proximate and distant world" (Leurs & Georgiou, 2016, p. 3697). The sudden occurrence of the Covid-19 pandemic indeed provoked novel negotiations of established relations and imaginaries of the city, as we will show below.

3. Methodology: Collecting Data in a Pandemic

In face of the acute Covid-19 pandemic, as well as with view to the demands of the specific research ethics of an approach that is sensitive to the situation of individuals in a crisis, we developed and applied a young people-centred qualitative longitudinal multi-method approach. Data collection was customised to research under social distancing conditions and thus took place completely online to protect the health of involved participants and researchers. For the research design, we combined written narratives with mobile smartphone methods to stay in contact with participants and interact with them in-situ. This article draws particularly on the results of the narratives. Narratives are an effective qualitative method for exploring individual experiences with and reflections on complex processes of change (Carlsson, Wängqvist, & Frisén, 2015; Laughland-Booÿ, Skrbiš, & Newcombe, 2018; McAdams, 2001, 2011). The method gives young participants a voice of their own and room for subjective descriptions and interpretations of their experiences and feelings (see Atkinson, 1998; Pabian & Erreygers, 2019) as well as more time to reflect on, structure, build and revise their thoughts (see Schulze, 2010). We applied narratives to reveal the breadth of the immediate effects of the pandemic on University students' everyday spaces and practices, as well as their potential variegated and flexible active responses to it. In this way, we wanted to learn in detail how participants make their everyday spaces and practices throughout the pandemic.

Data collection step 1 (DC1, 1–7 April 2020) of the longitudinal study was initiated during the strict lockdown and quarantine measures that were implemented in the federal province of Tyrol to curtail the spread of the new coronavirus. Only shopping for the most basic needs, commuting by essential workers and taking a stroll alone within the borders of each administrative community were allowed at that time. In this phase of data collection, we were especially interested in how the strict lockdown changed our participants' everyday life (contacts, education, sports, work) and everyday practices (both online and offline).

In early April 2020, it was impossible, even for health experts, to foresee for how long the measures taken by the Austrian and Tyrolean governments in response to the pandemic would need to remain in place. Accordingly, we were not able to predict the exact times and end of the data collection steps following DC1 and had to retain flexibility in the implementation of the next DCs. Eventually, DC2 (20–27 April 2020) was realised when the strict quarantine measures in Tyrol were slightly relaxed, and, for example, the reopening of small shops and the crossing of community borders was allowed. DC3 (2–14 June 2020) was conducted in the transition phase directly following the termination of the (first) lockdown to track how the return to life, free from lockdown and self-isolation, is being experienced. We aim to conduct a fourth round of data collection (DC4) during the next lecture period from autumn 2020 onwards, to track to what extent participants' lives have changed to previous daily or new routines (depending on whether the pandemic will change for the better or worse in Autumn). In this article, we draw on results from the narratives of DC1 and DC2, as we are focusing on how life under lockdown conditions was experienced and how study participants coped. The participants were students enrolled at universities in Tyrol aged 18 years or older (thus, legally adults) at the time of DC1. Recruiting took place via snowball sampling, i.e., via the broad networks of our student project team members. This approach enabled us to act swiftly in face of the pandemic and ensured voluntary participation. 98 young adults participated in DC1, 93 in DC2. Both those students who left Innsbruck during the quarantine period

for their hometowns and less-urban areas and those students who remained in Innsbruck were included in our study. Not only was the development of their relations to Innsbruck investigated, but also to their hometowns, where they stayed during the quarantine period. All participants received a written storytelling prompt for each of the narratives in a Microsoft Word file. In the prompt, they were invited to write a narrative, to file it in a text-processing software and to return the file directly to us after completion. Participants were asked to report their personal situation, their experiences and thoughts on the continued restrictions (or easing of restrictions) in response to the lead question: "How does the Corona pandemic and the current lockdown change your life?" Also, in every DC step we posed in the narratives questions as further points for reflection, e.g.: "How does the lockdown change your everyday life (contacts, education, sports, work) and your everyday practices? How do your everyday places change (online/offline)? How does your media use change?"

For an analysis of narratives, content analysis is widely employed and recommended as an analysis strategy (see e.g., Vandebosch & Green, 2019). As we aimed to investigate young adults' disrupted urban lifestyles and their digital mediation under Covid-19, we conducted the 'inductive category development' procedure by Mayring (2000, 2014) with the analysis software MaxQDA. For the analysis, we first went through all narratives, gaining an overview of discussed topics. We formulated inductive categories while determining the level of abstraction, and wherever necessary, subsuming and revising existing categories before we completed the qualitative content analysis.

4. Results: The Flight from the City, Urban Ills and the (Temporary) Digital Mediation of the City

In this results section, which sheds light on our findings, we first look into what we came to refer to as 'flight' from Innsbruck as experienced by young adults who left the city after lockdown measures were implemented. Second, for these students, from afar, the city was then only experienced through digitally-mediated contents and discourses through which it became constructed as a place of urban ills. Third, bereft of their urban activities and sociability, the participants engaged in digital media appropriation to rearrange their urban lives in the digital sphere for their digitally-mediated urban lives during the pandemic. In terms of their place of stay before the pandemic, in the data, we identified three segments among our participants: (1) A small group of students originally from Innsbruck, who either live with their families or in their rented accommodation in Innsbruck; (2) students who live in the larger region and commute to Innsbruck (including students from bordering communities to some that commute up to three hours by public transport one way, comprising trans-border commutes to neighbouring Northern Italy or Southern Germany regions); and (3) students from other places in Austria or from abroad who have rented places to stay in Innsbruck. During the pandemic, those based in Innsbruck remained in the city (first segment), whereas those of the second segment remained in their home places outside of Innsbruck. Many students of the third segment left the city early once the pandemic spread through Tyrol and Austria and related lockdown and social distancing measures were implemented by the regional and national governments. Hence, overall, a high number of our study participants spent at least the period of DC1 and DC2 outside the city of Innsbruck, while their experiences and imaginaries of the city became now mediated and constructed from afar.

4.1. The Flight from the City

For those participants who temporarily relocated, leaving the city usually meant moving back in with their parent(s) and siblings. For many, it also involved moving from the city of Innsbruck to either smaller urban or rural communities. As higher education institutions in Tyrol are home to a large number of students from abroad—particularly from the bordering states of Southern Tyrol, Italy, and Bavaria and Baden-Württemberg, Germany—for some, their temporary relocation was transborder. As these states and countries were implementing other local and national measures, this relocation significantly affected the students' exposure to such measures but also their possibilities of return once borders were closed. Travelling home was described by these participants as a solitary and surreal experience. Alexander, who left the city a few weeks into the lockdown and the start of self-isolation measures, described the estrangement to the city when he set out to travel to his family based in another part of Tyrol after his flatmate had also left the city and he eventually no longer endured living alone:

> The Anichstraße [main street in front of the university building] was empty, in front of the clinic entrance [there was] a white tent for corona patients and empty streets. The restaurants and shops were closed. On the way to the station, a strange feeling came up in me. The fact that a country can be shut down from 100 to 0 within a few days frightens me a little. There were two people on the bus and the station hall was empty. My journey home took place on 7 April, that is before the mask obligation in the public transport came into force. To be on the safe side I still wore mouth and nose protection. I met only two people on the way from Innsbruck to Kitzbühel. Even when changing trains at the station in Wörgl, [there was] not a soul. (Alexander, 22, DC2)

Besides those study participants who left Innsbruck by temporarily relocating, those who stayed, every once in a while, "fled the city" for activities such as walk-

ing, hiking, biking, climbing, in the mountains surrounding Innsbruck. According to the Covid-19 regulations in Tyrol, however, only going for a walk within administrative community borders was allowed during the strictest lockdown regulations enforced from around mid-March to mid-April. Several students, such as Sarah, who had moved to Innsbruck from Germany for her studies and in face of the pandemic decided to stay in Innsbruck, reported a new connection to the natural environment surrounding the city, almost a relation they had never felt before:

> It finally rained today, yay! I think I have never felt so connected to nature as I do now. There is nothing more beautiful for me than to walk in the forest to the Höttinger painting and breathe in the smell of the forest. Lovely. (Sarah, 25, DC2)

4.2. Urban Ills as Mediated from Afar

Those from the second and third segments of participants (students commuting to Innsbruck from the wider region and students with rented places in the city), who either had always been living outside of Innsbruck or who had temporarily relocated, found themselves locationally and socio-materially separated from urban life and space—at least as far as Innsbruck was concerned. Actual happenings in Innsbruck were now followed on (usually online) media or conveyed on social media by those friends and acquaintances that were still based in the city. While not all of these research subjects were concerned with what was going on in Innsbruck, those who did mention the city and urban life in our study often did so in reference to accounts of transgressions of on-going Covid-19 measures such as stay-home orders, social distancing and mask-wearing and risks associated with population densities in cities. Alexander, for example, reported how he was worried by Instagram stories that made him "doubt the sanity of many. Barbecues, birthday parties, family reunions, all this is becoming normal again, although officially the relaxation hasn't even taken effect yet" (Alexander, 22, DC2). Particularly during DC1 and partly during DC2, research subjects were upset by a perceived lack of responsibility of people in urban public places, potentially boosting the spread of the virus and, as a result, prolonging lockdown measures and related economic, social and psychological effects. In these narratives, the city was equated with a place of deviant behaviour and increased dangers in contracting the virus in dense and crowded city spaces and public transport. Strikingly, such accounts were narrated by those not present in the city such as Lukas, who lived in a community neighbouring Innsbruck, just 8km from Innsbruck main train station. He recalled:

> I heard from a friend of mine who lives in Innsbruck that there are a lot of people on the Inn [river next to the university campus] promenade in the evening, either for jogging/cycling or just to meet each other. For me, it is questionable how useful it is to meet more often now (when it is not necessary), and to do this without a mask. (Lukas, 20, DC2)

However, many participants' worries were not only based on digitally-mediated accounts of the city of Innsbruck, but they referred to the situation in cities more generally. Nele (23, DC1), who had moved back to her family's place in Eastern Tyrol wrote how she was "shocked by images of crowded parks, etc." mediated online. In a similar vein, Emil (25, DC2) reported how "this [relaxed behaviour] worries me a lot because as we have seen in Germany, the parks and city centres fill with crowds after the loosening as if the virus had already gone." Here, the city becomes mediated and imagined as a place of deviance and ill on a more general level.

While the city was seen by the young adults as a space whose dwellers do not have much scope to act in a pandemic to keep them and others safe, rural homes and the countryside were associated with low population density and thus less crowded conditions, health security, solitude, closeness to nature and the freedom to move—particularly during DC1 that was conducted during the strict lockdown and stay-at-home orders. Knowing that digital connectivity would ensure them to stay in touch with friends and peers, many young adults preferred in this situation the countryside over the urban centre of Innsbruck.

4.3. Digitally-Mediated Urban Life

With their university friends scattered across Tyrol and beyond and all public life put in lockdown, our study participants needed to find ways to make up for their urban social life and urban lifestyles that had suddenly been put on a hold. The urban activities that our participants described as disrupted were diverse, but most centrally the students suffered from a lack of mingling with friends at their homes, at cafés, restaurants, clubs, in the city's open spaces such as the Inn promenade. They missed participating in urban events, such as festivities, or being part of and contributing to non-governmental and community associations based in the city. They missed shopping and wandering through urban space. Further, some dearly struggled with opportunities of keeping up their sportive goals—once they were not able to do sports outside, go to fitness studios and join sports classes—and worried about their educational goals after abruptly being confronted with previously unknown and highly varied ways of distance learning. Yet, as we will show, many were inventive in adapting and shifting parts of these activities and sociability to the digital sphere. However, the degree to which they were satisfied with these mediated activities and experiences of the city and urban life varied greatly.

While our respondents belong to an age group that is usually associated with high media use, under con-

ditions of lockdown, many participants reported an even increased use of digital devices and digital media both in intensity and breadth of use. For example, Luca described:

> All in all, I'm using online media and digital devices much more than before to keep up face-to-face contacts, to educate myself, to distract myself or just to pass the time. Also, the frequency has changed, before the pandemic I was much less on YouTube, etc., but at the moment it is really daily due to study, pastime or entertainment….I have therefore downloaded several apps over the last few weeks, for example, Houseparty, Jitsi and Zoom for video chats. (Luca, 25, DC2)

For many, regular video conferences through Skype, Zoom, WhatsApp, Houseparty, Jitsi in the digital sphere were a way of relating to their now "absent friends" (Thulin et al., 2020, p. 167). These meetings in digital spaces were crucial for a feeling of maintained sociability in general but also for being and staying together and supporting each other through the pandemic as Elisa's account shows:

> The social contacts and the spaces in which social contacts take place have changed. For example, my closest friends and I have agreed to have a video conference at least once a week via Skype or WhatsApp. This has worked very well so far and I think it is important, especially in this situation, to take advantage of the opportunity to stay in touch with your friends. (Elisa, 24, DC1)

In DC1, these exchanges were particularly deliberately used by our participants to stay up-to-date and discuss worries, which became already less important at the time of DC2 when infection rates in Tyrol and Austria were in decline and social activities shifted more to having a good time despite the restrictions. In this way, the participants came up with pandemic-compatible solutions for popular joint pastimes such as watching a series together, as Sarah described: "For example, I'm currently watching a series on Netflix with a friend and we're talking on the phone, which is really fun" (Sarah, 25, DC2). Often confined to just a single room in their parents' places, for the young adults, digital media felt all the more "like a gateway to the outside world and friends/acquaintances" (Nele, 23, DC2).

Interestingly, the lockdown and social distancing measures were perceived as freeing the participants also from what now struck them as a "too much" of social meetings and peer pressure that had characterised their lives before Covid-19. These ambivalences in the experiences made by the young adults in the pandemic becomes apparent in Sarah's account who—while highly enjoying novel social activities such as telephoning while watching Netflix (see above)–thrived on the inner peace that suddenly filled her life:

> But I hardly miss many things that were once taken for granted. For example: Drinking a lot of alcohol, having house parties or having to do a lot every day. I hope that I can integrate the peace I have gained into my everyday life and that I don't fall back into old patterns too quickly, i.e., that I take the time to read and continue to go out into the fresh air a lot. (Sarah, 25, DC2)

Besides shifting their social activities, many respondents experimented with new applications and platforms to keep themselves occupied, as in the case of Sophia who took up the habit of using the group video chat app Houseparty: "I use the app Houseparty a lot to talk to several people at the same time. I didn't know the app before, but since the beginning of the pandemic, it has been in use almost daily" (Sophia, 22, DC2). The experimentation and appropriation of new apps and tools were not limited to social activities but came up in the narratives also concerning music and sports activities. Bereft of their places of physical exercise, the students searched for digital means that helped them keep in shape and found them in the form of live online sports classes, online sports challenges, fitness videos or workout apps. For example, Nele (23, DC2) reflected on her behaviour: "The usage of fitness videos and home workouts has increased many times over (since I usually go to the gym for that)." Likewise, Elena was excited to be able to attend a local yoga course via digital means: "A yoga studio from Innsbruck now offers yoga through Instagram and through Zoom online, which I think is a really nice thing! So, there is the possibility to do sports together with others via video chat" (Elena, 21, DC2). Similarly, Linius (21, DC2) reported having started learning playing the guitar with the help of an app, while Theo, who in turn taught guitar lessons, appropriated a video editing software to be able to move his music lessons online:

> In times of Distance Learning, I also changed my guitar lessons so that I create learning videos and tutorials with my mobile phone or record a song over several tracks and then cut it together as 'play along' with the help of Shotcut [video editing software]. Before the pandemic, I had no experience with this video editing program, but I have learned this program for my own benefit and am now profiting from it myself. (Theo, 28, DC2)

Indeed, Theo was not alone with this more or less forced acquisition of new digital skills. Nina, too, saw the digital platforms they had to use for university once courses were shifted to the digital sphere as an investment for their future career:

> I have never dealt with platforms like 'Zoom,' 'Easy Conference,' etc., before. Some of the professors wanted us to create virtual lectureships, but since I have little experience in this area, I had to learn about these platforms first and teach myself how they

> work. But I have to say that I am very happy about this because I think that it can be very useful in my later profession. (Nina, 22, DC2)

Taken together, despite the lockdown measures, all these digital means helped the participants to retain a "halfway normal life, which otherwise would not be imaginable," as Nora (23, DC2) concluded. Luis (22, DC2) agreed in their narrative to this high relevance stating that "online media and digital devices are very important right now. Without them, this crisis would be much more difficult and costly for me to manage."

In contrast to keeping up sociability and maintaining health, work and engagement in associations were hardly suited to be moved online and were instead put on a hold, with some exceptions. For example, while physical demonstrations and charity concerts in public spaces were not possible during the lockdown, Alexander (22, DC2) reported to appreciate and to have engaged with the #leavenoonebehind initiative which conveyed to him a feeling of solidarity with the wider community and those less fortunate in this global crisis:

> Especially the #leavenoonebehind community is strongly represented on this app. The live concerts try to ease the time until postponed concert dates. Personally, I think it is a good idea that many artists use the time to share their skills online with the world. It's a nice feeling to know that at the same time, people from England, the USA or maybe even your own neighbours are listening to the same concert. The well-known pianist Igor Levit, who usually fills halls like the Hamburg Elbphilharmonie, gives a short online concert almost every day. I'm glad to see that people who normally couldn't afford concert tickets like Mr Levit's can also get access to such artists in such a crisis. It gives a feeling of cohesion and shows that we are all in the same boat. It does not matter whether it is the Prime Minister of Great Britain who falls ill with Covid-19 or an ordinary citizen. No one is immune to the disease. Yet some are better protected, some are barely protected, and others are simply denied protection from the virus. This injustice often makes me think. (Alexander, 22, DC2)

However, particularly in DC2, almost all participants soon commented on the disadvantages of digital sociability and the aspects of urban life they increasingly missed, as mentioned at the beginning of this section. While they were first eager and happy to use digital means of interaction, many of the young adults in our study realised the lacking capabilities of social media to replace face-to-face meetings, the variety of social activities they had previously engaged in and also the physical-material experience of cityscapes. Digital space was appreciated as a way of maintaining friendships throughout the lockdown, yet it did not work for the participants to interact in more meaningful ways. Among the reported shortcomings were in particular the lacking quality and depth of digital relationality. Alexander (22, DC2) criticised digitality's lacking ability for bodily and haptic experiences, making him miss "a simple pat on the back or a hug." David (20, DC2) described how he was aware that many people even under strict lockdown had kept on meeting people in physical space. He said that he had some sympathy for them "because otherwise, you'll break down inside. Everyone needs friends or family," meaning thereby one needs them in physical space. Here, it becomes visible that for the young adults used to a socially rich urban life, digital sociability proves to be an insufficient substitute and no more than a temporary solution. Concerning the physical-material experience of the city, Sarah (25, DC2), for example, was eager to "go for a stroll…so just wandering through stores without buying anything."

Already during DC2, when the first relaxation of lockdown measures was enacted in Tyrol, a large part of those respondents who had remained in Innsbruck started meeting friends again in physical space—although most under specified conditions, e.g., encounters restricted to one or very few others to still minimise possibilities for a spread of the virus. While trying to act as reflexive as possible, these respondents invented their own rules of whom to meet, when and how—seeking to conform to regulations while simultaneously breaking them. However, particularly those who had moved to their parents' home or were not living in Innsbruck were now deprived of that possibility and also complained that digital meetings, as a result, were decreasing, cutting them off from their friends even more.

5. City Life No More? Discussion and Conclusions

The Covid-19 pandemic has been affecting all parts of daily life for hundreds of millions of people. Students are a group facing tremendous impacts; being in their qualification periods, they are per se in a period of life course change and uncertainty—even without a pandemic around. In this article, we have shed light on how students from the city of Innsbruck coped in very concrete ways with the interruption of their urban lives, lifestyles and activities. Innsbruck was—along with the rest of the province of Tyrol—subject to some of the harshest restrictions related to the Covid-19 pandemic within Austria and north of the Alps. Our findings make visible how despite their often-precarious situation, students were able to manage and showed resilience and resourcefulness in dealing with the situation.

In this article we highlighted three major findings: First, with lockdown measures coming into force, many students left the city, turning it for this group from a socio-materially-technologically experienced place (Bork-Hüffer et al., 2020) to a place solely digitally-mediated from afar. The discourses that reached these students through online news media and social media often evoked perceptions and imaginaries of the city as

a place of ills, constructed as a place where people deviate from expected behaviours under lockdown measures and framed as a risk space for the contraction of the virus. Second, young adults came up with and engaged in various digital activities with the intent to replace and thus keep up urban socio-cultural offline life—reaching from online gatherings, parties, sports classes to music events. As one participant described it, digital media under these conditions proved to be the "gateway to the outside world," being both the only way to experience their university city during the lockdown and an indispensable, yet insufficient lifeline for their sociability. In that sense, during Covid-19, "*all* online activities by urban Internet users" were not only "*inherently* urban" as stated, but it was *the main* (the visible and tangible) urban life that still existed for the young adults (Marolt, 2014, p. 3, emphasis in original). Hence, (temporarily) previous urban lifestyles, adapted to different degrees to the affordances of digital media, were shifted into digital space (e.g., digital house parties), as well as new innovative ways of digital socialising were created, all in all, producing alternative (digital) forms of an urban lifestyle and truly digitally-mediated urban experiences. Third, during the lockdown period, the importance, use intensity as well as the variety of digital media used by our study participants peaked tremendously. This trend, however, was short-lived as yearned-for offline sociability largely returned to the city once measures were relaxed—while simultaneously, distance learning stayed in place.

Similar to Jacklin-Jarvis and Cole's (2019) evaluation that digital media mainly serve as a way for maintaining friendships and exchange of information, our participants, throughout the lockdown highly appreciated the possibility to socially connect despite the physical distance, but soon pointed to the shortcomings of the digitally-mediated sociability and urban experiences. They dearly missed the city's socio-material spaces of encounter and sociability, making clear that digitally-mediated experiences are incapable of making up for urban social life in the long-run. Once those young people who were still based in the city started meeting offline again, their online sociability quickly returned to a state closer to the one before the pandemic. As a result, those who had left the city to join their families in their (often rural) homes or who had previously been commuting to the city from their (parents') homes became even more detached from their urban peers. As a further consequence, students' social relations became reappraised through the course of the pandemic in spring 2020: Those contacts to friends, fellow students and family with whom our participants had either continued to meet offline during lockdown or had quickly returned to meet after the relaxation of the lockdown were significantly strengthened, sometimes perceived as providing an emotional anchor, while other relations to non-family members they could not keep in touch with lost (sometimes strongly) in importance.

Even though our participants perceived digital media and online sociability as insufficient substitutes and were eagerly waiting for restrictions to be relaxed further, the appropriation of new digital apps and services will probably prove useful to them in several regards. First, in case the Covid-19 pandemic worsens in Austria and Europe once more in winter 2020, they will be prepared to adapt and shift their social and urban lives to the digital sphere. They will also know on whom to rely under these circumstances. Second, after the pandemic, when, sooner or later, their everyday lives go back to normal, these young people will probably be able to build on their heightened competence, knowledge and confidence in what digital media can afford them when needed. These affordances were manifold during the pandemic—used for keeping up (urban) sociability, (urban) leisure life, studying and working. In contrast to existing narratives that portray young people as a 'lost' generation that is overwhelmed in dealing with the crisis that the pandemic constitutes (see, e.g., Kahn, 2020; Privitera, 2020), we showed that many of our participants proved to be resilient in several ways in dealing with this situation (see Section 4.3). In this process, digital media played a tremendous role. The experience of self-effectiveness in coping and weathering this situation will most likely have a lasting and formative effect on these young people. Similar to the fundamental and probably permanent changes that currently take place in areas such as work and education, these young adults will build on their current experiences when faced again with disruptions in the future. The sustainability of the effects that this extraordinary situation has on our participants' urban lifestyles and their appreciation of a life closer to nature remains to be seen.

In closing, with this article, we seek to contribute to the very recent and just emerging geographical and interdisciplinary scholarship on the impacts of the ongoing Covid-19 pandemic to "bear witness and make sense of what is happening" (Rose-Redwood et al., 2020, p. 100). We will continue our longitudinal study with another data collection step in autumn 2020. At the time of writing this article in summer 2020, the near future for young people is still more volatile than ever before in their lifetimes. With a renewed (though small) increase in Covid-19 infections in Austria in July 2020, it also seems unlikely for the next study term beginning in October 2020 to return to 'business as usual.' Rather, we can expect months of distance learning ahead, while it remains to be seen how students will continue to handle the on-going restrictions imposed upon their urban lives and sociability by the pandemic.

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Conflict of Interests

The authors declare no conflict of interests.

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About the Authors

Katja Kaufmann is Postdoctoral Researcher at the Department of Geography, University of Innsbruck, and Guest Researcher at the Institute for Comparative Media and Communication Studies of the Austrian Academy of Sciences and the University of Klagenfurt. She holds a PhD in Communications from the University of Klagenfurt. Her research focuses on mobile media in everyday life, media and migration, and mobile method development.

Christoph Straganz is PhD Candidate at the Department of Geography, University of Innsbruck. He completed his Teachers Training diploma in Geography and Sports. His research focuses on pupils and their practices at the institution school as well as in digital space and he applies qualitative and digital methods.

Tabea Bork-Hüffer is Professor for Human Geography at the Department of Geography, University of Innsbruck. Her research centres around the intersections of digitisation, (im-)mobilities, and urbanisation, with a regional focus on Southeast Asia, China, and Austria. Previously she was Alexander-von-Humboldt Foundation Fellow at the Migration Cluster, Asia Research Institute, National University of Singapore and Postdoc at the Department of Geography at the University of Cologne.

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Article

Participatory Infrastructures: The Politics of Mobility Platforms

Peter T. Dunn

Department of Urban Design and Planning, University of Washington, Seattle, WA 98195, USA; E-Mail: ptdunn@uw.edu

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Abstract
Much of everyday life in cities is now mediated by digital platforms, a mode of organization in which control is both distributed widely among participants and sharply delimited by the platform's constraints. This article uses examples of smartphone-based platforms for urban mobility to argue that platforms create new political arrangements of the city, intermediating the social processes of management and movement that characterize urban life. Its empirical basis is a study of user interfaces, data specifications, and algorithms used in the operation and regulation of ride-hailing services and bike-share systems. I focus on three aspects of urban politics affected by platforms: its location, its participants, and the types of conflict it addresses. First, the programming forums in which decisions are encoded in and distributed through platforms' core digital architecture are new sites of policy deliberation outside the more familiar arenas of city politics. Second, travelers have new opportunities to use platforms for travel on their own terms, but this expanded participation is circumscribed by interfaces that presuppose individual, transactional engagement rather than a participation attentive to a broader social and environmental context. Finally, digital systems show themselves to be well suited to enforcing quantifiable distributional goals, but struggle to resolve the more nuanced relational matters that constitute the politics of everyday city life. These illustrations suggest that digital tools for managing transportation are not only political products, but also reset the stage on which urban encounters play out.

Keywords
digital geographies; infrastructure; participation; platform urbanism; shared-use mobility

Issue
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1. Introduction

In recent years, a smartphone in your pocket has for many become every bit as indispensable for getting around the city as car keys or a transit pass. Mobile apps provide information on the fastest driving routes through current traffic or the estimated arrival time of the next bus. They hail drivers of Ubers, and they unlock shared bicycles and scooters. Behind much of this new digital mediation of urban mobility is the platform, an arrangement that both facilitates and bounds social interaction. Digital platforms, fueled by big data and accelerated by the automatic operations of algorithms, have come to dominate the Internet (Helmond, 2015). With the proliferation of 'sharing economy' platforms like Uber and Airbnb, the platform's reach has become apparent beyond the computer screen and in the city, a move charted by the emerging literature on 'platform urbanism' (Barns, 2020; Leszczynski, 2019a; Rodgers & Moore, 2018). While these platforms have clearly become more present in our everyday lives online and in the city, what is sometimes less apparent is what they do differently than the systems they supplant. Is Uber simply a more convenient taxi? Or does it represent a qualitative transformation in how we engage with the city?

This article answers by examining the political dimensions of platform interventions in urban mobility. It uses two inherent and seemingly contradictory qualities of the platform—the centralized control exerted by its core structure and its openness to modification by its participants—to argue that mobility platforms are not neutral technical solutions applied to simple transportation problems, but are instead active players in shaping the engagements of urban inhabitants with

each other and their city. The platforms, in short, are political (Andersson Schwarz, 2017; Butt, McQuire, & Papastergiadis, 2016; Plantin, 2015), and the focus here is on politics in a particular sense. Following a generation of scholarship in science and technology studies, recent studies of platforms have looked at the consequences of platform politics—for example, the ways in which "digitality (re)produces power and extant sociospatial inequalities along lines of race, gender, class, sexuality, age, ability and more" (Elwood & Leszczynski, 2018, p. 630). At the same time, technologies are also products of socially situated human values, an argument at the heart of science and technology studies literature (Bijker, Hughes, & Pinch, 1987; MacKenzie & Wajcman, 1985) that applies equally to platforms. Work in the political economy vein, for example, has critically examined platforms as tools of value production and accumulation reflecting the capitalist paradigm of their creators (Langley & Leyshon, 2017; Srnicek, 2017). In this article, however, I position the platform not just as a product or producer of politics, but as the very site in which political engagement happens. Platforms have "politics" in the sense that Chantal Mouffe describes as an "ensemble of practices, discourses and institutions that seek to establish a certain order and to organize human coexistence" (1999, p. 754), a framing of power-laden resolution and exclusion that Crawford (2016) has successfully applied to the workings of software. The participatory nature of platforms, which are extended and modified by actors pursing disparate agendas, highlights this political function in ways that other sociotechnical systems do not. In this light, this article's contribution is to illustrate the politics of platforms by examining the ways that urban mobility platforms establish new arenas of deliberation, specify the kind of participant who is imagined to engage in the platform, and identify the type of disputes that can be resolved.

The empirical demonstration of this digitally mediated politics is a qualitative study of urban mobility platforms focusing on smartphone apps and supporting software for ride-hailing and bike share. The examples are of a data specification, a user interface, and an algorithmic approach to policy enforcement. Each of these three addresses a familiar concern for municipal regulators: traveler privacy, the use of single-occupancy vehicles, and bicycle parking in the public right-of-way, respectively. The application of platforms to these concerns, however, demonstrates the political dimensions of the platform's intermediation. In these examples, the platform transfers multiple local policy positions into a single standards-based design that then shapes subsequent use indiscriminately. It provides room for participants to exercise their own agency in their travel, but favors a participation that is individualistic and transactional. And it offers algorithmic resolutions to conflicts that are easily monitored and quantified, but struggles to mediate the messy everyday relations of people sharing space in the city. In each of these, the inherent qualities of digital platforms, as applied to urban mobility, shape subsequent modes of engagement among people in the city. Before presenting these cases, the following section discusses these qualities in a brief introduction to theorizations of platforms and platform urbanism.

2. Platforms as Participatory Infrastructures

The concept of the 'platform' has been used in Internet studies to describe the simultaneous expansion of user-generated content and concentration of control in a handful of companies. In a paradigmatic example, Facebook is characterized by users freely posting and interacting in ways that Facebook does not direct. At the same time, this participation is structured and monitored by Facebook's technical and institutional architectures, and it generates value that accrues to Facebook the corporation. As a platform, then, Facebook both decentralizes production and centralizes control of Internet content (Helmond, 2015). These seemingly contradictory tendencies, towards heterogeneous and expanded participation on the one hand and standardization and centralized control on the other, is the essential paradox of platforms (Ananny & Gillespie, 2016; Andersson Schwarz, 2017). Van Dijck, Poell, and de Waal (2018) define a platform as "a programmable digital architecture designed to organize interactions between users" (p. 4), and most definitions share these two essential elements: a core architecture or framework that is built and controlled centrally, and the participation of users in contributing to or interacting within its organization.

No single definition captures the many kinds of systems referred to as platforms in practice, and the term itself slides easily between technical, political, economic, and social definitions (Gillespie, 2010). Online, platforms describe social media, the sharing economy, and online marketplaces. In stricter technical definitions, platforms are not simply tweets or Uber rides, but are characterized by their programmability. Platforms like Microsoft Windows prescribe the software standards by which third parties develop new applications that operate on the platform, extending the platform's utility beyond the designs of its creators (Mackenzie, 2018; Plantin, Lagoze, Edwards, & Sandvig, 2018). More social perspectives see platforms as modes of interpersonal connectivity and templates for organizational management (Kelkar, 2018; van Dijck et al., 2018), while economic views characterize them as multi-sided markets facilitating connections between buyers and sellers. Their emphases differ, but these perspectives share an attention to platforms' bringing together of technical structures and social exchange.

Cities similarly comprise both built infrastructures and interpersonal relations, and recent work in 'platform urbanism' has articulated analytically fertile resonances between platforms and cities. Geographers have long insisted that the screen-based practices of the Internet are not merely 'virtual' phenomena somehow divorced from physical places, but instead are practices that occur

in and through already existing social and spatial contexts (Ash, Kitchin, & Leszczynski, 2018; Graham, 2005; Kitchin & Dodge, 2011; Thrift & French, 2002). In this vein, the emerging platform urbanism scholarship has taken theorizations of platforms developed mostly in media studies and drawn out their geographical and urban dimensions. By paying attention to the ways that platforms are actually lived out in everyday practices of, for example, labor (Richardson, 2020) and mobility (van der Graaf & Ballon, 2019), this work on the "emergent, irreducible, co-generative dynamics between platforms and the urban" (Rodgers & Moore, 2018) illuminates how the city has become a site for "the re-encoding or remediation of urban socio-spatial relationships into *territories for platform intermediation*" (Barns, 2019, emphasis in the original). Like platform studies more broadly, the emerging literature on platforms is multifaceted. Here I take two themes of platform urbanism as points of departure: infrastructure and participation.

First, an understanding of platforms requires engagement with theories of material infrastructures and their politics, argue Plantin et al. (2018). Increasingly, they say, digital platforms are taking on qualities of infrastructure by becoming ubiquitous, essential, and taken-for-granted (Star, 1999). At the same time, they see a "platformization of infrastructure" in the ways that public infrastructures like roadways that were once delivered according to an ideal of universal service provision are increasingly managed with differential access according to a neoliberal logic of individualization and profit (Graham & Marvin, 2001). In cities, the platform operates somewhat differently than infrastructure in that it reorganizes cities "not through new physical infrastructures, but instead through novel technologies of coordination" applied to existing infrastructures (Richardson, 2020, p. 460). The city's transit systems, sewer lines, and parks have been recognized as products of specific social values and power relations that then continue to shape cities through their material endurance (McFarlane & Rutherford, 2008; Winner, 1980). As city transportation departments who once delivered buses and bike share systems now, in addition or instead, provide transit data and permit third-party shared mobility vendors, platform urbanism offers a path for studying the power of the platform's central architecture through the lens of infrastructural politics.

Second, the platform's emphasis on the participation of its users leads platform urbanism to a focus on the city's people, not just its software systems. Antecedent studies and critiques of the smart city, which generally address large-scale deployments of digital technologies in the monitoring and control of urban systems, often employ a political-economic analytic of capitalism, neoliberalism, or technocracy aimed at the scale of a system or an organization. Leszczynski (2019a) has faulted these accounts for advancing "totalizing" narratives of capitalist domination that occlude any other analytical frames, particularly the actually lived experiences of people exercising their own agency in and through urban systems (see also Rose, 2017), and she cautions the study of platforms against taking the same path. The potential of platform urbanism, Leszczynski argues, is in offering "a more hopeful platform urban politics by extending and recognizing ordinary urban denizens' abilities to express political capacity through everyday digital interactions and practices" (Leszczynski, 2019a, p. 13). The participation and programmability inherent to platforms mean that we cannot understand a platform by studying only the system structure itself; we must also look to what people actually do with the platform (Fields, Bissell, & Macrorie, 2020; Leszczynski, 2019b). If, as Sarah Barns says, platforms are "highly participatory ecosystems of interaction" that "engender and reshape everyday selves and spaces in vital ways" (2019, p. 2), then the sociality of the city offers critical sites for examining the politics of platform participation.

Before turning to one such site, a final observation concerns the place of platforms in urban planning literature. Planners' attention to platforms to date has seen them primarily as disruptions to established regulatory regimes. Airbnb and Uber, in the most prominent examples, have sidestepped local governments' traditional controls of land use and transportation. Planners, in response, have sought to identify the public interest being served or impeded by these corporate platforms, then devised new regulatory approaches applicable to these technologies that will protect these interests (e.g., Gurran & Phibbs, 2017; Kim et al., 2019). Broadly speaking, this approach sees platforms as simply a different kind of infrastructure, a system to be managed such that benefits are distributed equitably and negative externalities are minimized. In contrast, the perspectives discussed above emphasize how the participatory qualities of platforms differentiate them from infrastructures, despite similarities in their material power. Rather than being objects of an external political deliberation, platforms are in important ways sites of politics themselves. A provider-regulator framing therefore risks oversimplifying the task of managing platforms by downplaying the ways that their inherent extensibility by users will always frustrate efforts at control, even by their creators. This "slipperiness" (Fields et al., 2020) or "ephemerality" (Graham, 2020) of platforms means that despite the influence of their core structure, there is often no single point of intervention through which to protect any identified public interest. Their political dimensions are therefore more extensive and more complex. The following examples seek to provide a more nuanced understanding of these qualities.

3. Case Illustrations: App-Based Urban Mobility

The remainder of this article takes these infrastructural and participatory aspects of platform urbanism as lenses for thinking through the political dimensions of app-based urban mobility. I use three examples of

mobility platforms—a data specification (the General Bikeshare Feed Specification, henceforth GBFS), a user interface (on Lyft's app for ride-hailing), and algorithmic tools for monitoring and enforcing regulatory compliance (for parking of Lime's shared bikes and scooters). Platforms are characterized in part by their capacity to bring together different categories of participants pursing different types of goals. Each of the following cases was therefore selected for its illustration of a particular kind of mobility platform actor: the software developer shipping a product, the end-user making a trip, and the vendor ensuring regulatory compliance, respectively. Furthermore, these three examples demonstrate how platform qualities appear at different technical and political scales. The organizations and software in these examples have international scope, but my investigation frequently grounds them in the specific experiences of a single city, Seattle. This city is used primarily to illustrate the interactions of platforms with a given regulatory environment, and so the particular demographic characteristics of the city are not directly relevant to the discussion.

The cases presented emerged from a larger research project investigating the nature of the public produced by digitally mediated urban mobility. Data was collected with a variety of qualitative methods. First, I reviewed public documents and testimony surrounding the City of Seattle's permitting of free-floating bike share vendors. In the summer of 2017, Seattle became the first North American city to host such a 'dockless' bike-share system. In August of 2018, at the completion of its initial one-year pilot, the city developed a new permitting structure (Seattle Department of Transportation, 2018), a process paralleling that of many other cities creating comparable regulations at the same time. The public discussions about the appropriate place for this emerging form of mobility in Seattle generated fruitful data on the policy response to a new and largely untested mobility platform.

I supplemented this Seattle perspective with attendance at two national industry conferences and by monitoring vendor news related to ride-hailing and free-floating bike and scooter share systems. Additionally, I followed the development of two open-source software projects related to mobility data, the Mobility Data Specification (MDS) and GBFS, on GitHub, a popular code repository. Their histories differ, but each is in a relatively early stage of development that is well-suited to an analysis of the process by which values and politics become incorporated into software. With this data from conferences, industry news, and code, I was specifically attentive to the ways that technical capacities of these systems shape the means by which various actors negotiate their intersecting agendas.

Finally, insight into the user experience of platform-mediated urban mobility was provided by 18 semi-structured interviews and three focus groups with Seattle-based end-users of mobility apps. To contrast different types of users, subjects were selected from two populations: young tech-savvy professionals and the residents of independent-living senior centers. In these discussions, I asked subjects how apps for hailing rides or accessing shared vehicles either restricted or expanded their abilities to meet their mobility needs.

There are limitations to the generalizability of these cases, which are products of their particular circumstances, and the specific politics of platforms will surely vary with different technical infrastructures or different participants. Still, these examples are instances of patterns that are expected to repeat, with variations, across other mobility platforms and in other places. In particular, the paradoxical coexistence of participation that is both restricted and expanded, an idea emerging from media studies research discussed above, is persistent across these examples. These cases illustrate this general tendency without claiming to represent the precise ways the politics will play out elsewhere. Ongoing scholarship in platform urbanism suggests that there is much work to be done to continue to trace the contours of these phenomena across cultural and technical contexts.

3.1. Infrastructure: Data Specifications as a Political Site

Data specifications, which govern the exchange of information over application programming interfaces (APIs) by defining a standard format for digital information, are at the core of platform architecture. Standards are of course not unique to APIs or platforms, and have been shown in many other contexts to exert power over behavior and relations (Busch, 2011; Galloway, 2004). Within platforms, APIs are the means by which heterogeneous external elements are brought into the scope of control of the platform (Bucher, 2013; Helmond, 2015). In the field of urban mobility, a handful of key data specifications underlie the APIs through which mobility service providers, municipalities, and users communicate. This illustration focuses on one such specification, GBFS.

Like most cities with bike sharing systems, the Seattle Department of Transportation (2018) requires bike share operators to produce APIs conforming to GBFS. This standard specifies, through a set of JSON schema, how the location of bikes currently available to rent is communicated from mobility vendors to third-party apps. Travelers using these apps can then find the nearest available bike at the moment. Seattle also requires data using a related standard, MDS, which provides a historical view of trips, including origins, destinations, and routes, within a given time frame to aid transportation officials in monitoring vendor performance and planning infrastructure improvements. While GBFS data is publicly available and is ultimately intended for use by travelers, MDS data is available only to regulators, in part because it contains sensitive information about individual trips.

Both specifications have developed as open-source projects with all code and documentation publicly available on GitHub (North American Bikeshare Association, 2020; Open Mobility Foundation, 2020). Besides being transparent, these projects are also ostensibly open to

contributions from anyone. While the open-source software movement reflects a belief in the benefits of more accessible and egalitarian participation in software development, research into these communities over the past two decades has shown how the persistence of social and technical barriers to joining (Steinmacher, Graciotto Silva, Gerosa, & Redmiles, 2015; von Krogh, Spaeth, & Lakhani, 2003) and contributing to (Ducheneaut, 2005; Nafus, 2011) such projects undermines any notion that they exist outside of preexisting social disparities. Both the GBFS and MDS projects state an expectation that their contributions will come primarily from a particular community—representatives of affected government agencies, mobility vendors, or third-party software providers. Each project has a few dozen listed contributors, a small portion of whom drive most of the discussion and development. Confirming previous studies of open-source software development, there are clear dimensions of deliberation and exclusion within these communities. The following example further illustrates how the development of the platform's core has implications for subsequent implementation by platform participants.

In the spring of 2019, a GBFS contributor raised a concern on GitHub that bike_id, a GBFS data field uniquely identifying the bicycle, could be used to reconstruct a trip if the ID is stable (North American Bikeshare Association, 2019b). By scraping data from this public feed, a nefarious actor could use bike_id to follow the location of a given bicycle, compromising the privacy of individual riders' origins and destinations. Other contributors generally agreed that this vulnerability should be fixed, and proposed a variety of technical changes to the specification to do so. Suggestions included securing bike_id with authentication, including it only in a separate authenticated feed, requiring vendors to change bike_id after every trip, and dropping it from the spec entirely. In discussing the merits of these options, in online discussion boards on GitHub (North American Bikeshare Association, 2019b, 2019c) over nine months and at a September 2019 conference workshop (North American Bikeshare Association, 2019a), the developer community revealed tensions in use cases and implementation of the specification.

For the end user, a public bike_id allows travelers to find and reserve a bike through a mobile app. In this use case, there is no need to know anything about the past locations of a given bike. However, bike share vendors and municipal regulators have also used bike_id for other purposes, such as monitoring fleet utilization or identifying 'stale' bikes parked too long in one place. For these uses, a stable bike_id is helpful. Resolving the privacy vulnerability created by a stable bike_id therefore also required clarifying the purpose of the specification itself. Among the "guiding principles" of GBFS is that it is "targeted at providing transit information to the bikeshare end user….GBFS is about public information" (North American Bikeshare Association, 2020). One contributor recognized that some cities had been using bike_id to track vendor compliance, but echoed this guiding principle in arguing that "GBFS is intended to be used for traveler-facing information…going forward privacy concerns outweigh alternate use cases like this for GBFS that fall outside its primary purpose." Ultimately, the accepted solution was grounded in these guidelines favoring the traveler, and this resolution suggested that MDS, which is specifically targeted at municipal users, could better support the other use cases.

A related issue in updating the specification concerned the ease of implementation of any proposed change. Since GBFS is already in wide use, any change to the spec that is incompatible with previous versions could require a significant investment of resources to implement across many producers and consumers of this data. A representative of Google Maps, for example, explained that their integration with one vendor, which allows users to reserve the vendor's bikes through Google's app, depends on a stable bike_id. Meanwhile, other mobility vendors said that they were already changing bike_ids in their data feeds, thus avoiding the originally flagged privacy vulnerability and minimizing the impact of requiring these ID changes.

In January 2020, a vote was held among GBFS contributors on GitHub to approve a proposed change to the specification requiring vendors to change each bike's bike_id to a new, random ID at the end of each trip. Seven contributors, representing both producers and consumers of GBFS data, voted in favor, and none against. The change has now been implemented in the latest version of the spec.

Kate Crawford (2016), in arguing that algorithms have politics, has pointed out that what appears to be the deterministic outcome of a computational process is better described as the superficial resolution of a still-present but obscured conflict. Here too, a technical fix has been implemented, but the alternatives, which might have better served certain users, simply disappear. Compromise and exclusion are in the nature of standards, and any software development must balance competing objectives. The city of Seattle has been proactive in defining its policies for protecting traveler privacy, including city data collection and handling (Seattle Department of Transportation, 2019), yet it has no direct control over the GBFS standard and its resulting privacy implications. Although consumers of GBFS can disagree about the relative merits of, say, traveler privacy and ease of data analysis for their given situation, the standardization requirements of the platform sharply limits their ability to engage on their own terms (Butt et al., 2016). Instead, deliberations and prioritizations that play out in software development forums propagate constraints across users universally.

3.2. Participation: Use Mediated by Interfaces

The discussion of data specifications has already hinted at limitations in platform participation. Despite being an

open-source project, contribution to GBFS is largely limited to those with a baseline of technical knowledge and a professional affiliation with a mobility service. Here, however, I focus on participation not in platform production, but in the broader sense of the platform's use. This participation, as in tweets and 'likes,' is the basis of the empowering 'connectedness' celebrated by platform proponents, but its power is regularly criticized as superficial and constrained, coming at the cost of an increased surveillance and commodification of intimate relations (Butt et al., 2016). For platform urbanism, 'participation' is not primarily about posting content on the Internet, but about a much broader scope of pervasive and mundane practices of everyday interactions, such that "the very nature of urban experience…becomes a site for platform intermediation" (Barns, 2019, p. 8). Getting around the city can in this sense be a kind of platform participation (van der Graaf & Ballon, 2019). In this view, a traveler setting her own origin and destination on Uber is creating a program on the Uber platform, a particular extension of the platform constrained but not determined by Uber. This section takes Lyft's user interface as an indication of the kind of participant this platform envisions and encourages, namely one who is a passive, individualistic consumer of a service.

In North America, Lyft is the second-largest ride-hailing platform, with fewer rides in fewer places than its rival Uber, but is nonetheless a dominant player in Seattle and most metropolitan areas. Like Uber, Lyft has promised city officials that, despite mounting evidence to the contrary, ride hailing platforms can reduce congestion and emissions in major cities. Central to this promise is the use of pooled rides, by which passengers unknown to each other who have nearby origins and destinations ride together in the same vehicle for some portion of their trip. Through its algorithmic coordination of demand, Lyft promises to move more people in fewer vehicles. The company set a goal in 2019 of making "shared rides account for 50% of all trips on the Lyft platform by the end of 2020" (Lyft, 2019a). Yet as one state transportation secretary remarked at an industry conference, the ride pooling algorithms are easy, but "it is actually behavior and culture that is the part of this that we are really having a hard time" influencing (Pollack, 2019). That passenger behavior—choosing the pool option within the app interface, sometimes walking a few blocks to a designated pickup location, sharing a back seat with a stranger, and making detours for additional stops—competes with a kind of participation that is narrowly tailored to the individual passenger's current needs.

The app interface illustrates this personalized focus. Upon opening, the Lyft app uses the passenger's current location as a default pickup point, then asks "Where are you going?" and offers a personalized list of destinations. Once the origin and destination have been identified, the app shows a map highlighting the expected route, as well as a choice of ride options, including pooled options, which include estimated costs and arrival times (Figure 1). Throughout the booking and travel process, the app provides instructions and images that are specific to the rider's particular journey—her origin, destina-

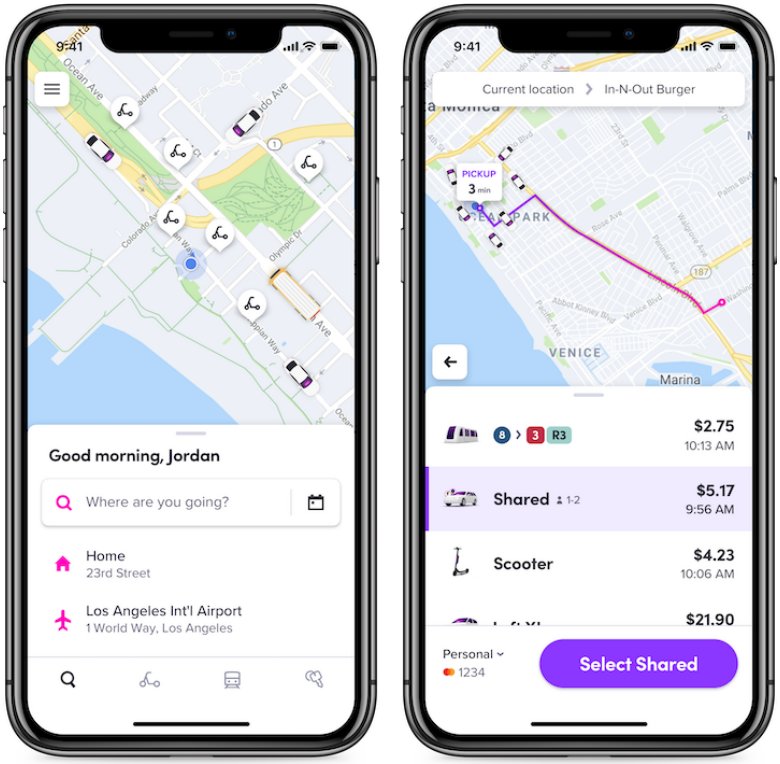

Figure 1. Screenshots from the user interface while booking a trip in the Lyft app. Source: Lyft (2019b).

tion, route, and vehicle—but little surrounding social or environmental context. Features like pre-populated destinations, automatic payment, and real-time arrival estimates, and door-to-door service are designed to minimize the effort a traveler must make to move around town on the Lyft platform.

The pool option is easy to select from available ride options in the app interface, and Lyft even says it has modified its interface to encourage sharing (Lyft, 2019a). The estimated travel times, however, are typically both longer and less precise. One finding of interviews with the users of ride-hailing apps in Seattle was that the cost advantage of pooled rides was often outweighed by their uncertainty. One subject called it a "gamble," and said he avoids pools if he is in a hurry. Another said he worried about sharing a ride with drunk or unruly passengers. These riders wanted to know when exactly they would arrive, but also who they would need to sit with to get there. The individual ride option, still the default choice in the app interface, delivers an experience that is more predictable and personalized.

In the Lyft interface, and in its use by a particular traveler, we find a site of tension between Lyft's stated corporate goal of increasing shared rides and its prioritization of rider convenience. This illustrates both the power and limitations of the platform architecture. As long as the Lyft app presents options, the agency of its users will preclude Lyft from fully specifying all its travel activity. This agency is a reminder that digital systems do not exert control universally (Rose, 2017), and platforms, as participatory systems, are inherently indeterminate (Leszczynski, 2019a). At the same time, we can see how the app design is indeed an active presence in the traveler's decision-making. Lyft's interface allows comparison of the time and monetary costs to the individual user, but makes no mention of emissions or congestion, the metrics by which the benefits of carpooling accrue at the city scale. The system's accountability is based largely on the ratings riders and drivers give each other, but there is no ability for actors external to the transaction to evaluate, say, whether a driver performed an unsafe maneuver or a rider blocked traffic for the sake of an easier drop-off. While we could imagine an interface that actively nudges users towards more socially aware decision-making, Butt et al. (2016, p. 737) suggest that the individualistic nature of platform participation might be inherent to the form, which "focuses on individual contributions to a social network" with "instrumental" goals, rather than envisioning a more collective social engagement. To participate in the platform is to exercise an expanded agency of mobility, but only within the confines of a structure that presupposes a certain set of individual goals and priorities.

3.3. Digitality: The Limits of Algorithmic Conflict Resolution

The efficiency and reach of platforms as digital technologies is a result of their collection and manipulation of data, and therefore requires "a radical expansion in the forms of social interaction and transaction that can be *rendered as data*" (Amoore & Piotukh, 2015, p. 345, emphasis in the original). Yet the reach of this digitization of everyday life is not unlimited. This section uses an example at the leading edge of digitization efforts, one app's automated parking-enforcement feature, to illustrate how platforms struggle to manage relations that are not easily monitored and quantified, even when they can automatically resolve more legible conflicts.

The city of Seattle's bike share vendor permit requirements document describes concern with the locations of shared bicycles at two scales. First, the city wants the bicycles to be available in neighborhoods across the city, and not only in the denser or richer neighborhoods likely to be most lucrative to vendors. The city permit therefore states that "the vendor shall distribute 10% or more of its deployed fleet in designated equity focus areas" (Seattle Department of Transportation, 2018, p. 50), neighborhoods that the Seattle Department of Transportation has identified for priority service (see Figure 2). Riders are allowed to complete their trips in any city neighborhood, but vendors have a responsibility to ensure adequate coverage at the beginning of each day, if necessary by redistributing bicycles. At a smaller scale, the city is also concerned with the location of parked bicycles within the public right-of-way. Free-floating bicycles do not have dedicated parking infrastructure, and so a rider can

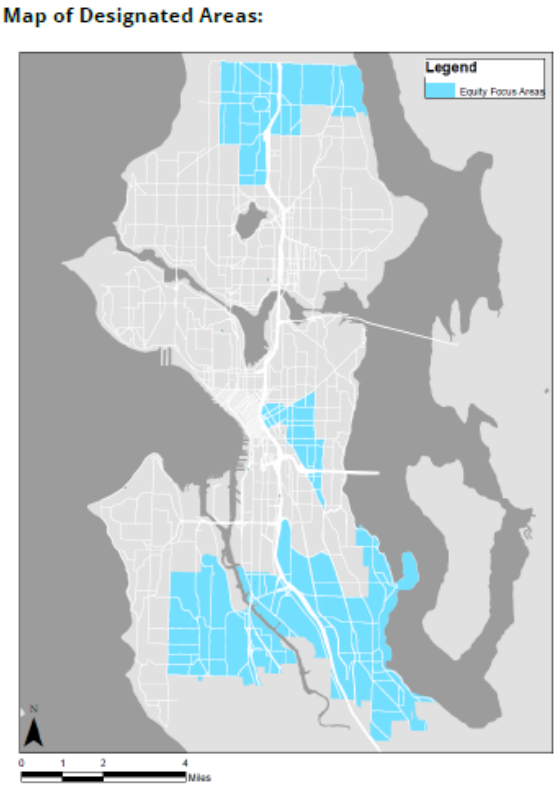

Figure 2. Map highlighting 'Equity focus areas' in which vendors must distribute 10% of their fleet. Source: Seattle Department of Transportation (2018).

lock and leave a bicycle anywhere upon completing a trip. To avoid bicycles blocking sidewalks, doorways, and road traffic, the city has specified where in the right-of-way bike parking is permitted (see Figure 3). In this function, the city regulation seeks to protect the interests of those who are not users of bike share but who nonetheless have an indirect stake in its operation. Although the rider is responsible for proper parking, the city holds the vendor accountable for parking violations.

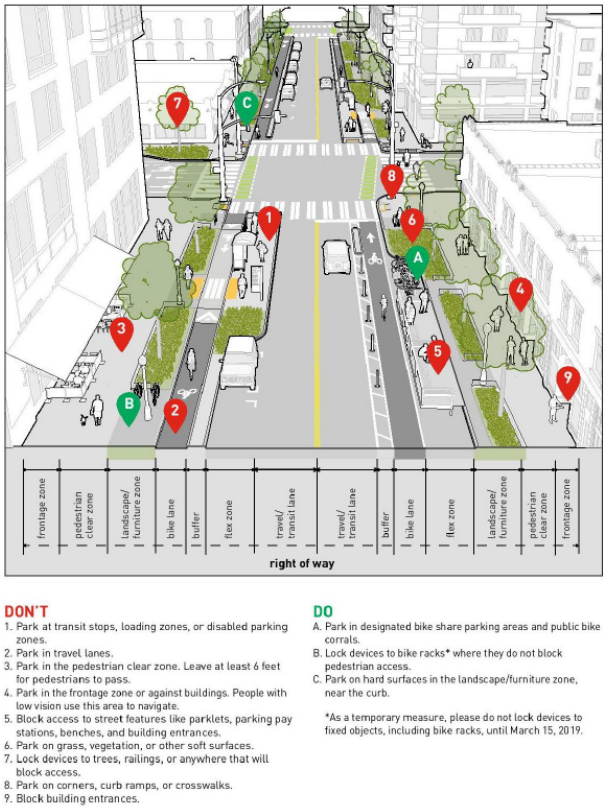

Figure 3. A diagram of a right-of-way showing where shared bikes should and should not be parked. Source: Seattle Department of Transportation (2018).

Digital technologies are involved in monitoring parking at both scales, but in very different ways. Each bicycle is equipped with a GPS receiver and periodically reports location data to the city using MDS. Seattle requires location accuracy to four decimal places in decimal degrees, approximately 10 meters. While some vendors provide more precise figures, reported location from these GPS units is generally unreliable beyond a few meters. For matching locations to neighborhoods, this spatial resolution is more than adequate. Given a dataset with the latitude and longitude of all parked bicycles at a given point in time, a city transportation official can easily calculate the number within the defined neighborhoods. Similarly, vendors can monitor a bicycle's location during a trip and notify the rider using a phone alert when they travel in or out of a geofenced no-parking zone (see Figure 4). A rider can also be automatically prevented from ending a trip in an unauthorized zone.

This location data is less helpful, however, for monitoring correct parking at the scale of the sidewalk. GPS cannot accurately differentiate between a bicycle parked incorrectly in the center of sidewalk and one parked properly one meter away, nor can it indicate the orientation of the bicycle—parallel to the sidewalk, perpendicular, or prone. Even with more accurate location data, Seattle would need to compare this against geographic data describing the right-of-way in great detail, including all street furniture, vegetation, building frontages, and entrances. Such high-resolution data is not available.

Figure 4. An SMS notification to a bike share rider upon entering a geofenced no-parking zone. Source: Author.

Parking education, monitoring, and enforcement is therefore largely managed without direct digital intervention. Signage on the bicycles themselves, graphics in the app, and instructional materials from both the Seattle Department of Transportation and the vendors instruct riders about proper parking, and the Seattle Department of Transportation conducts routine street audits of parking. However, one vendor, Lime, has suggested a path to automate parking enforcement. Upon completion of a trip, the Lime app asks the rider to take a photo of the parked vehicle. Separately, an in-app feature called Parked or Not (Figure 5) invites users to view photos of parked scooters, then indicate if they are parked correctly or not. Although Seattle does not currently permit scooters, cities that do apply similar restrictions on parking. In announcing the feature on its blog, Lime called it a "fun" way for "engaged riders to take

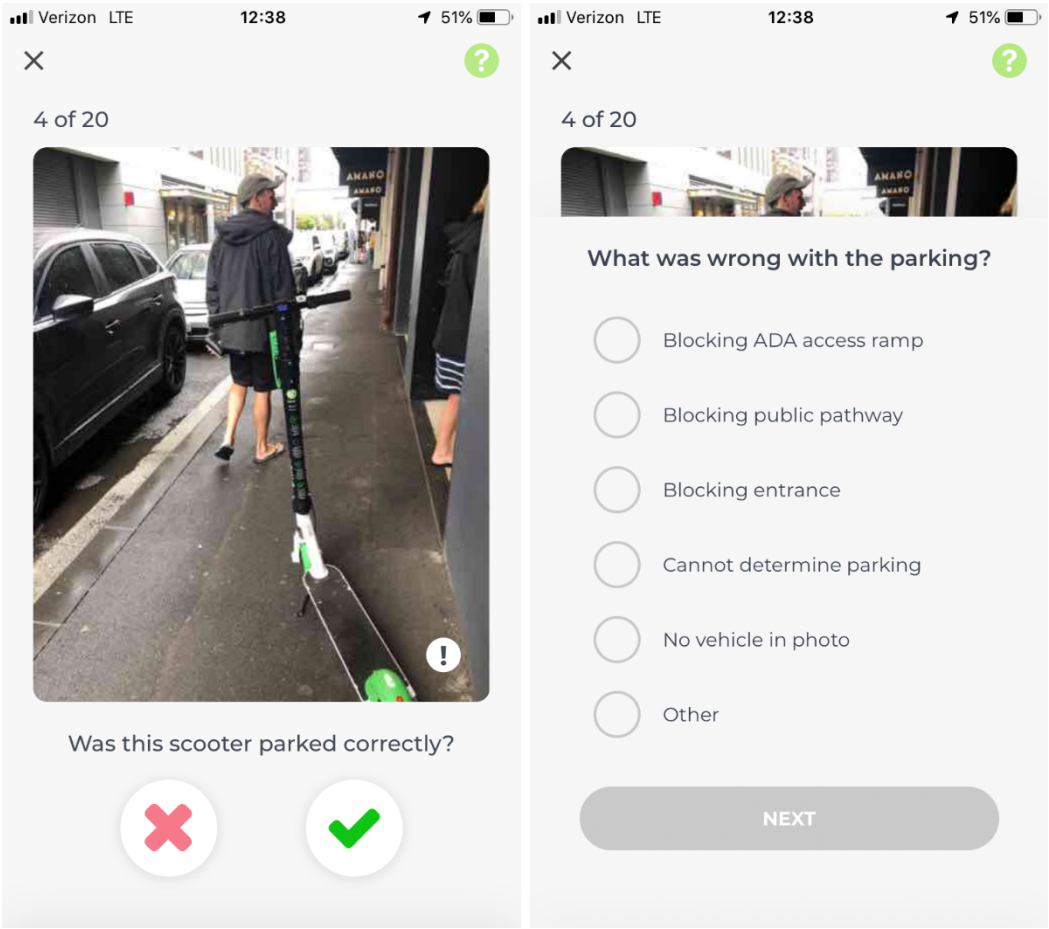

Figure 5. Screenshots of Lime's Parked or Not feature. Source: Author.

an active role in educating" other riders (Lime, 2018a). Less obvious to the user is that it is also a means of creating a scalable digital enforcement tool. The Parked or Not lead explained that "the next step is to develop statistical models that help us identify positive and negative behavior" (Lime, 2018a), and Lime, in its app for a Seattle permit, mentions its work "building out and implementing machine learning techniques to create an automated system that can verify rider's parking jobs" (Lime, 2018b). The apparent purpose of Parked or Not, then, is to use the human identification of images of correct and incorrect parking to create a training dataset that teaches an artificial intelligence to do the same automatically and at scale.

The details of the development and deployment of such systems are not publicly available, and the Parked or Not feature is no longer available on Lime's app. Still, a closer look at the possible mechanisms of this feature can help to illustrate the limitations of digital management of parking conflicts. First, the tool is of course not entirely digital, relying on hidden labor (Irani, 2015) whose value accumulates to the platform owners (Srnicek, 2017). Beyond these economic concerns, one problem with the system is its assumption that proper parking in a dynamic, three-dimensional urban context can be accurately identified from a single image. The standardized approach also elides any local regulatory differences, since users are asked to evaluate parking without knowing anything about the nuances of parking guidance in the jurisdiction of the photo.

Indeed, the question of what constitutes 'correct' parking is largely subjective. Despite the specificity of Seattle's parking restrictions, they leave room for reasonable disagreement about whether a bike accords with the regulations, or whether those restrictions are actually appropriate for a given situation. Unobtrusive parking might be less of a concern on a quieter neighborhood street than on a high-traffic downtown sidewalk, for example. The ways that we occupy shared public spaces are inherently relational, requiring continual negotiations large and small among inhabitants whose goals sometimes collide. Lime's automated parking monitoring would presumably enforce a de facto parking standard blind to this social context. Indeed, the app effectively overlooks the very people who might be best situated evaluate proper parking. In mediating relationships among Lime, the Lime user, and the city regulator, the app excludes the external community of those who are directly affected by its use of public space. These interests are represented in the platform only indirectly through the city's regulations, and the platform's community is implied to be the actual users of the bikes and scooters.

At least two differences can help explain the gap between the fairly straightforward digital monitoring of neighborhood distribution and the more complex automation of parking enforcement within the right-of-way. One is scale. The limited resolution of both bicycle location data and city geographic data means that the identification of a bicycle as either inside or outside of a desired zone is far more reliable at the scale of the neighborhood than at that of a human body on a sidewalk. A second issue is the difference between quantifiable targets and goals with a more qualitative, subjective character. In contrast to interpreting appropriate parking, calculating the percentage of bicycles available in defined neighborhoods is a fairly objective matter of locating and counting. The latter is more readily quantified and digitized, while the former can be digitized only clumsily, as Parked or Not illustrates.

4. Conclusion

Digital platforms are political in the ways they monetize participation and accumulate value (Srnicek, 2017), in their automated reproduction and acceleration of preexisting relations of domination (Noble, 2018), and in their mediation of everyday discourse and information exchange (Gillespie, 2018). Studies of technology have long emphasized that a given technology is a product not only of those who directly create it, but also of those who exercise their own agency in using it in particular ways to meet their own needs (Kline & Pinch, 1996). However, as platforms further blur the distinction between production and use, these technologies become participatory in new ways. This demands a greater attention to the ways that they not only reflect and shape social values and relations, as science and technology studies has long argued of technology, but also how the platform becomes a site of value formation and relation building in itself. While such a framing is well established in studies of online social media, platform urbanism has more recently suggested a way to understand the digital organization of urban space as well. The examples of urban mobility technologies presented here have focused on three characteristics of the platform—its centralized architecture, its user participation, and its digitality—to argue that these constitute sites in which social relations are both enacted and ordered. These digital platform politics play out not just in code, but in everyday urban spaces, where they are made apparent in trip visibility, transportation availability, and the negotiations of shared public space. Through these examples, this article has pointed to a conceptualization of platform politics that connects the platform's technical organization and the means by which actors engage with one another in urban space.

The data specification, interface, and algorithmic tool presented here have each illustrated the simultaneous openness of platform participation and the confines of platform architectures. As infrastructures, they are easily overlooked regulators of everyday behavior, while as forums of participation, they are relational and indeterminate. GBFS is an open-source specification with accessible contributor roles and a transparent development process. As a standard, however, it overrides local variations, limiting the ability of cities, or indeed travelers, to control their own data. On the Lyft platform, riders can move through the city in ways specific to their own needs, but this practice is constrained by an interface that presupposes an individualistic transaction. GPS monitoring of shared bikes is a way of ordering the messiness of participation on free-floating bike share platforms. This architectural control is limited, however, to practices that can be easily digitized. In the end, the platform frustrates any simplistic reading of its politics as inherently liberatory or oppressive. Yet as digital technologies "scale beyond the chambers of city halls and on to the personal networked devices of (nearly) every urban denizen" (Leszczynski, 2019a, p. 5) and as platforms become "urbanized" (Barns, 2019), the nuanced political arrangements attending the configurations of these digital platforms demand our careful consideration. With such a perspective, we can begin to see participation in the city as, in part, participation in its digital infrastructures.

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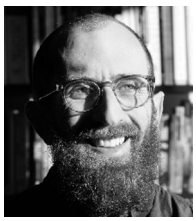
About the Author



Peter T. Dunn is a Doctoral Candidate in the Interdisciplinary PhD Program in Urban Design & Planning at the University of Washington. He is interested in the everyday use of digital technologies in the city, and his research examines dimensions of personal autonomy and public participation in smartphone apps for urban mobility.

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Article

"Look How Many Gays There Are Here": Digital Technologies and Non-Heterosexual Space in Haikou

James Cummings

School of Art, Media and American Studies, University of East Anglia, Norwich, NR4 7TJ, UK; E-Mail: j.cummings@uea.ac.uk

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Abstract
This article explores the capacities of digital technologies to disrupt, redefine and multiply urban spaces, creating new ways of seeing and experiencing cities. Based on ethnographic research into the lives of men who desire men in Haikou, People's Republic of China, and their uses of the location-aware dating app Blued, I show how the city is produced anew as a space imagined and engaged in relation to the perceptible presence of other men who desire men. In a sociopolitical context in which non-heterosexual lives are largely invisible in public spaces, the digitally mediated visibility of Blued users to one another invites a range of social practices through which urban spaces, as well as spatial categories of 'the urban' and 'the rural,' are reproduced at the intersections of sexuality, space and digital technologies. With its empirical focus on an 'ordinary' city in a non-Western context, this article challenges both the Eurocentricity of much digital geographies research and its tendency to focus on global cities.

Keywords
China; digital; gay; Haikou; Hainan; sexuality; space; technology

Issue
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1. Introduction

At around 10pm on a typically steamy April evening in Haikou, People's Republic of China (PRC), myself, my partner Jerry and our friends Xiao Long, Ah Fan and Li Pei sat around a table amongst the mobile food stalls that gather every evening in a street opposite the South Gate of Hainan University. It had become a tradition that a couple of times a week we would meet at the pool in my nearby apartment complex, swim for a while, and then eat at the South Gate food stalls. We all lived within a 300-metre radius of where we were sitting. We knew this not because we had told each other but because we had come to know each other through Blued, a location-aware mobile app used by men in the PRC to find sex, friendship and romance with other nearby men. The food stalls were at their peak of business; students and local residents sat squeezed, shoulder to shoulder, on plastic stools around fold-away tables while motorbike taxis cut a path through the throng with their honking horns. We were waiting an unusually long time for our food to arrive and a lull in our conversation turned Xiao Long's attention to his phone: "Fuck! Look how many gays there are here!" he exclaimed, as he turned his phone to Ah Fan, Blued open. Intrigued, the rest of us followed suit, picking up our phones and opening Blued to survey the plethora of nearby men: "This guy's cute, right?," Xiao Long continued, "he's only 10 metres away, he must be here somewhere." The hunt was on for username: Dream Big. We each began to scan the crowd, our attention so focused that the eventual arrival of our food garnered only a distracted "thanks." "Is that him?" asked Li Pei, as he raised his eyebrows and glanced at a point in the crowd behind my left shoulder. We followed Li Pei's gaze to where a man in his early twenties sat at a table with a group of women. Dream Big glared back at us with a look of both panic and excitement, he then promptly placed his phone face-down on the table and returned to his conversation with the women around him.

When men who desire men use digital technologies to find one another, their experiences of urban spaces are altered, and spaces may be reproduced as sites of significance in their sexual geographies. As in the above vignette, social relationships can be established on the basis of proximity in offline spaces and those spaces of proximity can be transformed; a 'nearby' swimming pool becomes a meeting place for men who desire men and a crowded night market becomes their hunting ground. Such spatial reformulations are facilitated by digital technologies that layer new knowledge onto offline spaces. Yet, these dynamics are not determined by technologies alone. Rather, they unfold as an interplay of technological, social, political and economic forces (Wajcman, 2010). In this article, I explore how digital technologies, especially the location-aware dating app Blued, are used by men who desire men in Haikou. I argue that these technologies shape the ways in which users imagine and engage with the city and, by mapping the presence of other men who desire men, foster the production of particular sites of sexual significance. Attending to the wider contexts within which these dynamics are located, I situated the digitally mediated production of these spaces within the political and social realities of non-heterosexual lives in Haikou and the PRC more broadly. By offering insights into a non-Western and 'provincial' setting, this article advances the field of research into interrelations of space, sexuality and digital technology, which has been dominated by research on major urban centres in European and Anglophone contexts.

I draw on 12 months of ethnographic fieldwork in Haikou (2015–2016), including 12 semi-structured interviews with men who desire men aged 24–63 and participation in their everyday social practices. This time spent in Haikou was part of an 18-month period of fieldwork across Hainan. A total of 30 interviews were conducted with men aged 18–63 across Haikou, Sanya (a city in the south of Hainan) and various smaller cities, towns and rural sites. This wider research sought to understand how men who desire men in Hainan negotiate understandings of themselves and their lives in relation to a range of everyday social and material contexts, amongst which digital technologies were key. While the primary focus of this article is on Haikou, I also draw on this broader dataset and include examples from other cities in Hainan.

In this article, both I and my interlocutors use a range of terms to refer to same-sex desires and identities, including 'non-heterosexual,' 'gay,' 'tongzhi' (literally 'comrade'; see Bao, 2018, pp. 28–32, for discussion) and 'homosexual.' I most often use the term 'men who desire men.' This is in avoidance of the assumption of stable identities inherent in the terms 'gay' and 'tongzhi,' the pathologising under-tones of 'homosexual' and the reduction of social experience to a sex act embodied in the more common term 'men who have sex with men.' These issues of terminology are complex and contested in cross-cultural sexualities research (see Boellstorff, 2007, for discussion).

2. Research Contexts

2.1. Haikou

Haikou is the provincial capital of Hainan, an island province of the PRC which lies in the Gulf of Tonkin, 19km off the southern coast of the PRC mainland. Haikou is the political and economic centre of Hainan and has a population 1.9 million (Statistical Bureau of Hainan Province, 2017). While this makes it the largest city on the island, Haikou is diminutive by comparison to most other provincial capitals in the PRC. Along with Hainan more generally, Haikou has long been considered a peripheral backwater in both the state and popular geographic imagination (Feng, 2005). It is classified as a 'third tier city' in the PRC's four tier system of ranking cities by population size, economic output, infrastructure and political and cultural influence (Ministry of Commerce of the People's Republic of China, 2020). In 2016, when this research was conducted, average disposable income in Haikou was RMB 30,775 (Statistical Bureau of Hainan Province, 2017). This was below the national average of 33,616 RMB for urban areas and well below the average of RMB 50,883 in the PRC's 'first tier cities': Shanghai, Beijing, Guangzhou and Shenzhen (National Bureau of Statistics of China, 2017).

In Haikou, as elsewhere in the PRC, limited public discourses on sexual diversity and pervasive Confucian cultural norms that valorise heterosexual reproduction mean that very few men who desire men make their sexuality known beyond social networks of other men who desire men. Anecdotal accounts from older men in Haikou suggest that non-heterosexual spaces first emerged in the city in the mid-1990s when men began meeting on a particular pedestrian bridge. Later, an alternative meeting place was established in a nearby park, where men continue to meet today. Haikou's first gay bars are said to have appeared in the mid-2000s and, since 2007, there has always been at least one gay bar in the city. Most bars have been short-lived and a total of five gay bars have opened and closed at various locations over the past 13 years. Haikou's current gay bar has been in operation since 2013, making it the longest surviving. Since 2008, infrequent social gatherings have been organised by informal 'LGBT' community groups and AIDS prevention organisation targeting men who have sex with men.

2.2. Blued

Despite the 1997 removal of legal stipulations that rendered same-sex sexual activities punishable under the crime of 'hooliganism' and the 2001 de-classification of 'homosexuality' as a mental illness (Wu, 2003), state censorship continues to limit mainstream media representations of gender and sexuality to cisgendered, heterosexual relations and activist organisations are closely monitored by the state (Bao, 2020). In this context,

online platforms operate as privileged sites for the representation of sexual diversity and the formation of non-heterosexual social networks and identities (Ho, 2010). Since the early 2010s, mobile, locative dating apps have become one of the primary ways in which men who desire men in the PRC find one another, these include apps such as Grindr, Jack'd and Blued (Wang, 2018; Zhao, Sui, & Li, 2017). Such technologies use global positioning software to make users aware of their offline proximity to one another. In a sociopolitical context in which non-heterosexual lives are largely invisible in public spaces, these technologies play an important, even revolutionary, role in the everyday lives of men who desire men in the PRC, enabling social and sexual intimacies otherwise largely curtailed by pervasive heteronormativity (Cummings, 2020).

Launched in 2012, Blued has become the most widely used non-heterosexual locative dating app in the PRC. As of 2020, Blued boasts 40 million users, 28 million of whom are located in the PRC (Blued, 2020). The app's success in the face of state censorship and regulation in the PRC is, in part, due to its prohibition of sexually explicit imagery and language and its self-branding as a tool to support AIDS prevention work (Lopez, 2014). The app offers a range of social media functions, including personal profiles, private chat and the ability to video live-stream. Its primary function and main draw, however, is its use of global positioning technology to present users on a grid interface in relation to their distance from one another in offline space (Figure 1).

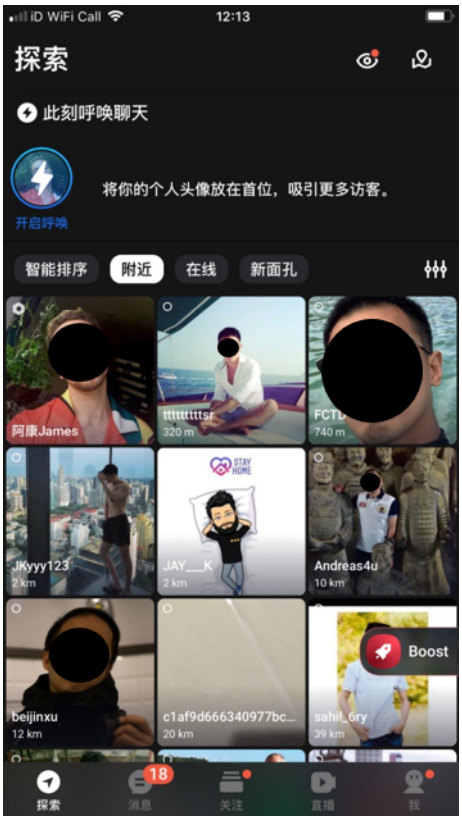

Figure 1. Blued interface. Source: Author.

3. Sex and the Digital City

In what has been deemed a 'digital turn' in geography, scholars have illuminated the capacities of global positioning, mobile and data gathering technologies to transform the ways in which cities are experienced (Ash, Kitchin, & Leszczynski, 2018). The ubiquity of such technologies in contemporary urban environments has led some to conclude that cities now wear a 'digital skin' in the form of networks of technologies that gather and share information on the daily to-and-fro of urban life (Rabari & Storper, 2015). As such, cities exist not only in their physical structures and the movements of goods, people and capital but also in ever-increasing volumes of digitally captured and shared knowledge (Couldry & Hepp, 2017). Access to this knowledge is unevenly distributed between governments, businesses, individuals and distinct social groups variously creating and connecting to diverse digital networks (de Souza e Silva & Firth, 2012). Cities, therefore, do not wear a digital skin but multiple skins: They become vastly different spaces depending upon one's access to, and position within, digital networks of knowledge (Foth, Brynskov, & Ojala, 2016).

Geographers of sexuality have explored the specific significance of digital technologies and their mediation of offline spaces for non-heterosexual people (Miles, 2018; Mowlabocus, 2010; Nash & Gorman-Murray, 2019). The Internet has long enabled marginalised sexual groups to access information, build communities and experience social and sexual intimacies (Campbell, 2004; Döring, 2009; Gudelunas, 2012; Pullen & Cooper, 2010). As such, digital technologies and connectivity have been seen to have reduced the role of gay bars and cruising sites as vital hubs for urban non-heterosexual communities; the advent of mobile same-sex dating apps has further dislocated non-heterosexual communities and identities from fixed spaces (Miles, 2017; Nash, 2012). At the same time, however, scholars have drawn attention to the ways in which digital technologies may foster less the deterritorialisation of non-heterosexual communities and identities than the emergence of new and complex relationships between space, technology and sexuality (Bonner-Thompson, 2017; van Doorn, 2011). Researchers have explored how mobile, location-aware dating apps can imbue any space with the possibility of intimate non-heterosexual connection, rather than those spaces explicitly marked as sexually significant (Stempfhuber & Liegl, 2016). This has been seen to challenge heteronormativity by facilitating same-sex connections within everyday spaces otherwise characterised by naturalised assumptions of heterosexuality (Roth, 2014). Cockayne and Richardson (2017) have theorised such dynamics as the 'queering of code/space'—a technologically mediated reproduction of spaces that makes possible the transgression of regulatory sexual norms.

These debates on the nature of relationships between space, digital technologies and contempo-

rary sexualities have largely focused on European and Anglophone contexts (Szulc, 2014). Literature on non-heterosexual lives in diverse locations beyond the 'West' has documented the vital role that the Internet and digital technologies play in identity construction and political organisation (Das, 2019; Gorkemli, 2012). This is especially the case in contexts, such as the PRC (Bao, 2020), where state authoritarianism and conservative cultural mores maintain pervasive heteronormativity. However, less attention has been paid to what these technologies mean for the everyday spatiality of non-heterosexual lives in diverse sociocultural and political settings. Broaching these themes, Choy (2018) has noted how the location-aware mobile dating app Butterfly allows Hong Kong lesbians to escape the heteronormative ordering of their everyday lives and find one another as they move through the city. In his work on LGBT organisations in Singapore, Luger (2019) argues that activists circumvent the prohibition of sexual rights-themed public events by gathering in public spaces while only acknowledging the purpose of their gathering in online settings; they thereby lay claim to public space without risking state interference.

Further, research into geographies of sexuality more broadly, both within and beyond the 'West,' has tended to privilege national capitals and major economic, political and cultural centres (Stone, 2018). This scholarly orientation reflects and perpetuates popular perceptions of such sites as sexually liberal and progressive in contrast to smaller, 'ordinary' cities, towns and rural areas, imagined as sexually conservative. Halberstam (2005) has termed such geo-sexual imaginaries 'metronormativity' and has highlighted the necessity of attention to non-heterosexual lives across diverse geographic settings. Importantly, as critical geographers have argued, spatial categories of the metropole and the margin, the urban and the rural, or the city, the town and the village, are not independent of one other but are articulated relationally (Massey, 1994). As such, understanding relationships between sexuality and urban space requires attention to co-constitutive discourses of 'the urban' and 'the rural' and their imagination as distinct sexual spaces (Detamore, 2013; Herring, 2007; Johnson, Gilley, & Gray, 2016).

In the following sections, I explore a range of ways in which digital technologies shape the spatial imaginations and experiences of men who desire men in Haikou and Hainan more widely. In doing so, I contribute to the above literatures, offering new insights into the interrelations of space, sexuality and digital technologies in a non-Western and 'provincial' setting. I begin by addressing the relational construction of spaces as 'urban/rural' vis-à-vis the visible presence and absence of men on Blued. I then turn to accounts of the impact of digital technologies on 'traditional' non-heterosexual spaces (gay bars and cruising areas). Finally, I suggest that Blued has facilitated the emergence of new non-heterosexual spaces in Haikou that exist only in the interstices of the online and the offline. Across these sections, I ague that digital technologies disrupt, redefine and multiply urban spaces in Hainan and offer men who desire men new ways of seeing and experiencing the urban environment.

4. Mediating 'the Urban' and 'the Rural' as Sexual Spaces

While particular urban spaces have their tangible materiality, 'the urban' itself is more difficult to grasp. As it is figured in everyday discourse, the urban is not an objective geographic demarcation but an imagined site suspended in webs of meaning and representation that concern who lives, and what life is like, in different locations (Massey, 1994). For men who desire men in Hainan, 'the urban' was often articulated against 'the rural' and the imagination of both spaces was mediated by digital technologies.

Many participants in urban settings spoke of an urban/rural digital divide. On the one hand, the uneven geographic distribution of Internet access and digital technologies has been a facet of wider socioeconomic inequalities between urban and rural settings in the PRC (Fong, 2009). On the other hand, such invocations of a digital divide are also one of the key ways in which 'the urban' and 'the rural' come to be imagined as distinct spaces (Graham, 2011). This was evident in participants' reflections on the lives of rural men who desire men. 29-year-old Ah Gang and 26-year-old Xiao Pang both lived in Wuzhishan City in central Hainan. They discussed how a digital divide may impact men in "far off villages'':

> Ah Gang: Last time, we were talking about what it would be like for someone in one of those far off villages.
>
> Xiao Pang: Without Internet, so far away.
>
> Ah Gang: In those villages, they don't have Internet, they come into the city to go to school and find out that they are gay. There was someone like this who we met up with…he realised that he liked men while he was still in his village, that's quite a feat, in that kind of village.
>
> Xiao Pang: There would be no one to tell him.

From their own urban location, Ah Gang and Xiao Pang imagined that a defining feature of non-heterosexual lives in rural settings is a lack of access to the Internet. This was seen to leave men in "far off villages" isolated from information that would enable them to recognise themselves as "gay," to make sense of their sexual desires and claim belonging to a collective identity category. Here, 'the rural' is seen as isolated, not only in terms of geographic but also informatic and digital distance from the urban. In this geo-digital-sexual landscape, Internet-enabled access to certain forms of sexual knowledge becomes a definitional quality of 'the urban.'

As such, it appears that if rural men are to "find out that they are gay," they must "come into the city" and connect to the Internet.

Distinctions between 'the urban' and 'the rural' were made not only in terms of Internet access but also Internet and digital literacy and its implications for the ways men who desire men connect with, or remain isolated from, one another. 54-year-old Ah Zheng lived in Sanya, the second largest city in Hainan. He contrasted digitally literate men in urban settings with men in "the countryside," whose apparent inability to use digital technologies left them excluded from non-heterosexual social networks. He described these men as 'anchang,' a derogatory term used to comedic effect by men who desire men that can be literally translated as 'hidden whores':

> There are a lot of *anchang* who don't come and hang out, those in the countryside…*anchang* are outside and they don't come into contact with people like us….It's hard for them to get the information, it's backward, it's backward in the countryside, and they live there so they don't get this kind of information, these softwares; they don't understand how to use these kinds of apps.

Ah Zheng's definition of 'the countryside' as 'backwards' was premised on the apparent digital illiteracy of rural men who desire men. Digital literacy, here, comes to serve as a standard that informs the recognition of spaces as 'rural' or 'urban' and as 'backward' or 'progressive.' Unable to "get this kind of information" and "use these kinds of apps," the 'anchang' that Ah Zheng describes are seen as isolated from social networks of non-heterosexual men; as he put it: "They don't come into contact with people like us." Through the imagination of a digitally illiterate and 'backward' countryside, occupied by isolated men, the "people like us" to which Ah Zheng refers implicitly come to signify digitally literate, progressive, urban, and connect men who desire men.

Such spatial categorisations vis-à-vis digital technologies and practices are intensified by way in which Blued serves to map the presence of other men who desire men. As Blued renders perceptible the offline proximity of other users, it offers a visualisation of the number of users within a certain geographic radius. For some participants, the relative 'profusion' and 'scarcity' of Blued users informed distinctions they made between spaces at various scales. 45-year-old Lu Ge, who lived in Sanya, exemplified these dynamics as he reflected on using Blued to look for other men outside of Hainan's largest cities: "When we go down to the counties, smaller places, like Wuzhishan, somewhere like that, you won't see a single person all night, there's no one on that app [Blued]! [Lu Ge laughs] It's like there's no one there."

Here, the presence and absence of other men "on that app" within particular geographic demarcations is a central feature in relation to which such demarcations are themselves articulated. For Lu Ge, the apparent paucity of men on Blued in "the counties" and "smaller places" was a definitional quality of those spaces themselves; it became part of the ways in which such spaces are categorised as "somewhere like that"' and experienced as 'big' or 'small,' 'urban' or 'rural.'

These accounts from men who desire men in Hainan show how 'the urban' and 'the rural' are articulated and experienced in relation to digital technologies. It is important to note, however, that these assumptions of limited Internet access and literacy in Hainan's rural areas contrast with the experiences of participants who either lived or grew up in villages and smaller towns. Speaking of his home village in Chengmai County, 23-year-old Ah Run noted: "Our gay scene back there is like this, I found that softwares are just like gay bars for us."

In this sense, the above accounts may not represent an actually existing digital divide between 'the urban' and 'the rural.' Rather, the conflation of urbanity with Internet access and sexual connectivity appears to be a discursive strategy and form of metronormativity through which urban men who desire men frame themselves and their spatial locations as 'modern' and 'progressive' in contrast spaces imagined as digitally and sexually 'backward.'

5. Digital Technologies and 'Traditional' Non-Heterosexual Spaces in Haikou

Regardless of whether the above-discussed 'digital divides' are a discursive tool or a material and experienced reality, each of the above excerpts points to the central role that digital technologies played in participants' everyday social and sexual interactions. As noted earlier, research conducted in 'Western' cities has suggested that the rise of digital media has reduced the social significance of 'traditional' non-heterosexual meeting places, such as gay bars and cruising sites (Nash, 2012). Many participants suggested that this is also the case in Haikou.

Many participants similarly felt that the ease with which other men could be found and contacted online meant that fixed, offline non-heterosexual spaces were no longer necessary. 18-year-old Xiao Qiao lived in a small town in Chengmai Country in northern Hainan. He often made the one-hour journey by bus into Haikou to socialise at the city's gay bar. Despite this regular patronage, when asked what he felt the impact on his life would be if Haikou's gay bar were to close down, he replied:

> I don't think it would have an impact…the main reason that you go to a gay bar is, like I was just saying, to go looking for friends….But now you can meet people entirely through Blued, arrange on Blued to meet and go singing, get a karaoke booth, meet up and have fun. This is another form of gay bar, even

> though in name it isn't a gay bar, but if you arrange to meet with some people, go there for fun, isn't it exactly the same as a gay bar? If, for example, there was no Internet, I think that gay bars would allow *tongzhi* to communicate, but now the Internet is everywhere, so, for us, gay bars are just somewhere you go for a bit of excitement.

For Xiao Qiao, the ability to "meet people entirely through Blued" had not rendered Haikou's gay bar irrelevant, however, it had fundamentally changed its meaning and function. Bars were seen to have once been vital sites at which to "go looking for friends" and build communities. With these functions now served by digital technologies, bars become simply "somewhere you go for a bit of excitement." Xiao Qiao also points to the ways in which digital technologies enable the creation of new and temporary non-heterosexual spaces. In contrast to the fixity of a gay bar, as men find one another online and arrange to meet in offline spaces, the sexuality of those spaces is temporarily transformed such that "a karaoke booth" can become "another form of gay bar." These processes of temporary, fluid and partial redefinition of otherwise heterosexual spaces are explored in more detail in the following section.

For Xiao Qiao, the excitement that Haikou's gay bar offered was enough to ensure that he continued to visit. Several participants made similar comments and felt that gay bars still provided a fun and safe space within which they could experience social belonging and relax without the regulatory surveillance they felt in heterosexual spaces. Others were less certain that gay bars remained socially relevant in the face of digital technologies and connectivity. As such, digital technologies were not only seen to shape the meanings and social function of gay bars in Haikou but were recognised as a threat to their sustainability. As Ah Gang commented:

> In the past, in Haikou, there wasn't just that one gay bar, [there were] three or four. But later, for economic reasons, they shutdown. Back then there weren't softwares; those few gay bars emerged along with online chatrooms, offline they would go to those few bars. But now there's only one bar left. As softwares have developed people don't want to go there to meet other people anymore.

The economic struggles, and resultant impermanence, of gay bars in Haikou are not solely the consequence of their replacement by digital technologies. In the 'first tier cities' of Beijing, Shanghai, Guangzhou and Shenzhen, larger populations, higher wages and a steady stream of domestic and international visitors ensure the economic viability of a certain number of gay bars and allow for elaborate decoration and a varied schedule of entertainment activities (Bao, 2020). By contrast, gay bars in Haikou are dependent upon a comparatively small local market with limited spending power and wary of visiting explicitly non-heterosexual spaces 'so close to home' for fear being seen by family members or colleagues. These economic and social constraints mean that gay bars in Haikou have limited cash flow, basic decoration and have historically been located in low-rent sites in the city centre. As such, they struggle to attract already hesitant customers and many participants voiced their dissatisfaction with the environment in Haikou's gay bars. It is under these already fraught economic and social conditions that the sustainability of gay bars in Haikou is threatened by further reductions in the numbers of patrons due to the ease and anonymity of meeting men online.

Interestingly, as Ah Gang notes above, in Haikou, "gay bars emerged along with online chatrooms." This parallel emergence of online and offline spaces within which non-heterosexual men meet contrasts with 'Western' contexts in which gay bars and other offline meeting places in urban centres predated widespread use of the Internet by decades (Bell & Binnie, 2004). The relationship between 'traditional' non-heterosexual spaces and digital technologies in Haikou is therefore more complex than a matter of the former being replaced by the latter. This was also the case for the cruising site that exists in a park in Haikou, which, as noted earlier, was established in the mid-1990s. As 42-year-old Yefeng recalled:

> There was a hotel by the side of the park with an Internet cafe on the ground floor; it was the first place in Haikou where you could get online. So, there were people who would go there to go online and look for other *tongzhi*. When they found someone, they would arrange to meet in the park….So, like this, it became a *tongzhi* meeting place.

As scholars have argued, the development of non-heterosexual identities in the PRC is intimately linked to the proliferation of digital information and communication technologies (Cummings, 2020; Ho, 2010). It appears that the development of 'traditional' non-heterosexual spaces in Haikou, and likely elsewhere in the PRC, is similarly caught-up with these technologies, raising the question of whether these offline sites should be considered 'traditional' at all.

Even in recent years, in which mobile smartphones and dating apps have decoupled access to both the Internet and to other men who desire men from fixed locations, these same technologies may also be involved in the production of 'traditional,' fixed non-heterosexual spaces. This is exemplified in the case of Sanya's current gay bar Tianchi. The bar was established in 2012, the same year that Blued was released. As the new app sought routes to access its intended market, Blued offered to pay gay bars in the PRC to advertise the app. Tianchi took advantage of this and used money from Blued to install a large, illuminated sign by its entrance (Figure 2). In return, the sign featured Blued's name and logo. This sign adorned Tianchi's doorway until 2015, when the bar relocated. The sign was so effective that,

Figure 2. Blued sign outside Tianchi. Source: Author.

before the app became widely known and used, some men in Sanya believed that it was in fact the bar itself that was named 'Blued.' For Tianchi, a further benefit of this sign and its inclusion of Blued's logo was the way in which it tacitly announced the presence of a gay bar without the need for explicit terms to refer to sexuality. In the political and social climate of the PRC, and Hainan in particular, the use of terms such as 'gay,' 'tongzhi' or 'homosexual' in Tianchi's publicly visible signage could risk attracting unwanted attention from the general public and the authorities. It would also deter local non-heterosexual people from visiting the bar for fear of being seen entering. In this context, the illuminated logo of an app catering to men who desire men turned Tianchi into a visible non-heterosexual space while ensuring that it was visible as such only to those familiar with Blued.

6. Locative Technology and the Queering of Public Space in Haikou

As the above discussion shows, the digital is often perceived as a threat to materially situated, offline non-heterosexual spaces, and yet it is simultaneously involved in the production, redefinition and recognition of such spaces. In this sense, the digital and the material, or the online and the offline, are not opposed to, but rather intimately intertwined with, one another. This is nowhere clearer than when men who desire men use Blued to map one another within offline spaces and their understandings of those spaces are radically changed.

In the context of pervasive heteronormativity in the PRC, almost all participants discussed the role of early Internet technologies, such as websites and chatrooms, in facilitating their first access to sexual discourses beyond heterosexuality and in enabling their first contact with other men who desire men. With the move to locative technology in the form of Blued, these online forms of knowledge and intimacy can be mobilised within, and mapped onto, offline spaces. 26-year-old Xiao Lei exemplified these dynamics as he recalled the first time that he used the Internet to access diverse sexual discourses:

> Xiao Lei: [My classmate] asked me to go with him to an Internet cafe to log on to this website. So, slowly, we learned that, like: 'Oh, this is gay.' At first, it was very difficult; I felt like I was a pervert….Before I found out that there were so many people like this all around me, I thought that there was only me, I hadn't found out that anyone around you might potentially be someone in this scene….It's been a long time since I've logged on to that website.
>
> James: Why is that?
>
> Xiao Lei: Because now there is Blued [Xiao Lei laughs]….You can use Blued to chat on your phone; now you can see who's around you. It's a lot more convenient than using a computer. If you're out with your friends and you're bored, you can have a look who's around you, see what handsome guys are in the area!

Xiao Lei's early access to diverse sexual discourses online led to his realisation that he was neither "a pervert" nor the only person "like this." Knowing that "anyone around you might potentially be someone in this scene" was fundamental in Xiao Lei normalisation and acceptance of his desires for men. With the arrival of Blued, this 'potential' presence of other men who desire men is transformed into a perceptible reality, as other users become visible within one's immediate offline 'vicinity.' Echoing Xiao Lei,

for 24-year-old Dingfeng, Blued offered access to a "hidden world" beneath the heterosexual surface of everyday spaces:

> These apps give us a way of knowing that this hidden world exists; you don't feel so lonely; it's like they shine a light onto this hidden world and let you sense it; they let you know that it exists.

In these accounts, Blued functions as a lens through which offline spaces and their occupants become visible in new ways. This not only shapes how men who desire men in Haikou feel about themselves, others and the spaces they share but also gives rise to new spatial-social practices which, in turn, establish new non-heterosexual spaces in the city.

As seen in discussions of 'the urban' and 'the rural,' Blued makes visible one's proximity to, and the density of, other users across multiple spatial scales. In Haikou, this has led to the production of certain urban spaces that are understood as densely populated by men who desire men. One such place is the men's wear section on the fifth floor of a particular shopping centre on the city's bustling Jiefang West Road. I was first taken there by a friend who had heard that there were "a lot of gays there." This rumour was confirmed upon opening Blued and finding other users just metres away. This densely packed, windowless warren of string vests and skinny jeans subsequently became a site we would regularly visit. With our phones in our hands, we would spend our evenings feigning interest in clothes and shoes, all the while casting glances at the shop owners and other shoppers, trying our best to recognise these men as those that Blued told us were just metres away. Seeing other men, phones in hands, we would assume they were doing the same and, on occasion, a knowing smile or the familiar sound of an incoming Blued message would tell us that, indeed, they were.

Other such spaces exist in Haikou: Another popular shopping centre in the more affluent Guomao area; Hainan University campus, with its heightened collocations of young men and, unsurprisingly, the stretch of road along which both Haikou's gay bar and cruising area are located within 300 metres of one another. Each of these are spaces within which Blued makes visible elevated densities of users and, as such, the expectation that "anyone around you might potentially be someone in this scene" becomes part of the way in which these spaces are constructed and experienced by men who desire men. As men tell one another that "there are lot of gays there" and see this confirmed via Blued, these spaces become landmarks in shared sexual geographies of the city. The extent to which these new non-heterosexual spaces become widely recognised as such requires reliably high densities of Blued users such that this becomes a definitional feature of these spaces. It also depends upon the widespread sharing of this knowledge such that it becomes part of the cultural repertoire of local non-heterosexual communities. Such spaces are therefore established only slowly and infrequently.

Much more often, spaces are temporarily redefined, as Blued makes visible the surprising presence of another user at close proximity. This was the case in the vignette with which this article opened, when a night market was temporarily transformed into a landscape across which men who desire men search for one another in the hope of establishing social and sexual relationships. Such temporary subversions of the heteronormative order of spaces happen countless times whenever a Blued user spots 'a cute guy nearby' and their immediate surroundings suddenly take on new sexual significance. Yet, these subversions leave no lasting mark upon the spaces within which they occur. The social and political significance of such subversions is therefore ambiguous; they are, at once, radical challenges to the sexual order of public spaces under pervasive heteronormativity and fleeting moments of excitement that are soon forgotten.

Participants largely celebrated these new possibilities for men who desire men to see and engage with one another in public spaces. Yet, there were instances in which the potential to be identified as non-heterosexual caused anxiety. These concerns often surfaced in discussions of Blued users who did not include a photo of themselves on their profiles and were, therefore, able to recognise other users in offline spaces but did not render themselves recognisable in the same way. As 24-year old Liang Zongwei recounted:

> Liang Zongwei: When I'm out, I might receive a message that says "hey, I've just seen you at such-and-such a place." I just think "whatever." But I have a friend who gets very nervous, he'll say, "oh no, I've been recognised!"
>
> James: What is it that your friend is afraid of?
>
> Liang Zongwei: There are people who don't put their own photos on there, they will threaten you. I have a friend who has been threatened. Someone threatened to expose him in his workplace; it was one of his colleagues, you know…he said he had to do what they told him.

As Liang Zongwei illustrates, uneven relations of recognisability across online and offline spaces can leave men who desire men open to blackmail. In the PRC, the exposure of non-normative sexuality within family and professional settings can have serious repercussions, including the termination of these relationships. As such, caution must be taken in claiming the liberatory potential of Blued to transform public spaces into sites in which men who desire men are visible to one another. While this may challenge the enforced invisibility of non-heterosexual men in public space, for some men, invisibility was a desirable form of protection from homophobic violence. In contrast to joyous accounts of digitally medi-

ated public visibility, for men such as Liang Zongwei's friend, Blued's mapping of users within offline settings turned the streets of Haikou into spaces of risk and fear.

7. Conclusion

Geographers of sexuality have concluded that "the Internet, new media and mobile apps, appear to be fomenting a new 'sexual revolution,' one that is rewriting how we understand what our bodies can 'do' and how we comprehend ourselves as sexual beings" (Nash & Gorman-Murray, 2016, p. 353). As this article has shown, these technologies are also rewriting the spaces we occupy and how we comprehend those with whom we are co-present. These digitally mediated shifts in the sexual ordering of spaces are not only occurring in the 'Western' and/or major-city spaces that have been the focus of much existing work. They are also unfolding in 'ordinary' cities the world over and are shaped by specific social, economic and political forces therein. In Haikou, and Hainan more widely, the use of digital technologies by men who desire men is shaping what it means for a space to be seen as 'urban' or 'rural' and the imagined nature of sexual cultures therein. As elsewhere, the rise of digital technologies has changed the social significance of 'traditional' non-heterosexual spaces, such as gay bars and cruising sites. Operating in an already unfavourable economic and social context, this may threaten the sustainability of such spaces in Haikou; yet, there are also instances in which the digital and the 'traditional' have emerged as intertwined. These capacities of digital technologies to shape urban spaces are strikingly clear in the emergence of new non-heterosexual spaces in Haikou that exist in the interstices of the online and the offline as urban densities of men who desire men are made visible on Blued. Such disruptions of otherwise heterosexual spaces are cause for celebration as they open-up possibilities for men who desire men to claim public space. Yet, their political significance is limited by their often fleeting and individual nature and the heightened risks of homophobic violence that come with visibility in public space.

This article has sought to advance research into urban geographies of sexuality in the digital age by looking at the experiences of men who desire men in a non-Western and 'ordinary' city. While this article has explored digitally mediated discursive constructions of 'the rural,' further research is needed into how digital technologies are shaping the lives and spatial experiences of men in rural areas. Non-heterosexual women are also notably absent from both this article and the spaces it has explored, raising questions of how and where non-heterosexual women are finding one another and what role digital technologies play in these processes. Finally, the dynamics discussed in this article are premised on assumptions that digital, locative technologies offer accurate representations of the offline, physical presence of other users. Further research should consider the roles that technological failure and experiences of disjunct between the online and the offline may play in the digitally mediate production and disruption of urban space.

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Conflict of Interests

The author declares no conflict of interests.

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About the Author

James Cummings is a Senior Research Associate at the University of East Anglia. His research explores the production of sexual identities, subjectivities, lives and spaces at the intersections of social, political and technological change in the People's Republic of China and the United Kingdom. His forthcoming monograph *The Everyday Lives of Gay Men in Hainan: Community, Space and Time* will be published with Palgrave Macmillan in 2021.

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Article

The Hybrid Space of Collaborative Location-Based Mobile Games and the City: A Case Study of Ingress

Ulysses Sengupta, Mahmud Tantoush *, May Bassanino and Eric Cheung

Manchester School of Architecture, Manchester Metropolitan University, Manchester, M15 6BH, UK;
E-Mails: u.sengupta@mmu.ac.uk (U.S.), mahmud.tantoush@mmu.ac.uk (M.T.), m.bassanino@mmu.ac.uk (M.B.), p.cheung@mmu.ac.uk (E.C.)

* Corresponding author

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Abstract
Structural changes in the way we live and interact in cities are occurring due to advances in mobile communication technologies affecting everyday practices. One such practice, at the forefront of digital technology adoption, is digital gaming or play. Location-based mobile games (LBMGs), such as Pokémon Go and Ingress have surged in popularity in recent years through their introduction of a new mode of play, employing mobile GPS and internet-enabled technology. Distinguished by their embedded GIS, LBMGs can influence how people play, interact with and perceive the city, by merging urban and virtual spaces into 'hybrid realities.' Despite the popularity of such games, studies into how LBMGs affect urban dweller interactions with each other and the city have been limited. This article examines how the digital interface of the large-scale collaborative LBMG Ingress affects how players experience and use the city. Ingress is a collaborative hybrid or location-based game that uses GPS location information from smartphones, Google maps, and Google POI to create virtual gameplay environments that correspond to and interact with other players and the city. The methodology cross-references the MDA framework from game studies (Mechanics-Dynamics-Aesthetics) within the urban mobility, sociability and spatiality characteristics of the hybrid realities theoretical framework. In this article, we explore how Ingress (re)produces hybrid space through deliberate design of interface game elements. By applying this analytical approach, we identify the game mechanics and their role in producing a hybrid gameplay environment with impacts on social and mobility practices altering the perception of and engagement with the city.

Keywords
augmented reality; collaborative LBMG; digital interfaces; hybrid spaces; Ingress; location-based mobile games; MDA framework; urban space

Issue
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1. Introduction

> Spatial planning is currently being confronted with unprecedented change, which is taking place at the interface between traditional environments and the rapidly evolving virtual world….Change under discussion here is partially digitally constructed and virtually produced, affecting and transforming space and place. No one knows precisely what the developments that emerge from this hybrid space between the material and virtual worlds will precipitate. (de Roo & Yamu, 2017, p. 11)

Digital technologies are increasingly becoming part of our daily existence, and their meditating influence on our everyday practices in city life is causing a fundamental transformation of culture and practice (Ash, 2015; Castells, 1996; Manovich, 2001; Rabari & Storper, 2015). Technological advancements in both software and hardware technology have led to a certain type of digital

games called location-based mobile games (LBMGs) or hybrid reality games (HRG). Such games employ augmented reality as a technological aspect within the hybrid realities theoretical framework. While there is a distinction between the definition of HRG and LBMGs in literature, we use them interchangeably in this article. The spatiality of digital games, in general, have evolved from simple two-dimensional to complicated three-dimensional worlds (Shaw & Warf, 2009), and now to complex (relational) hybrid multi-dimensional spaces (de Souza e Silva & Sheller, 2014). Hybrid space can be understood as a space between material and virtual worlds (de Roo & Yamu, 2017, p. 11). A more nuanced understanding rejects the binaries to recognize a new logic of hybridised space emerging as a product of interrelations and entanglements between spaces (de Souza e Silva, 2009; McLean, 2020, p. 3). In a similar vein, Montola (2005) points to the blurring and breaking of traditional boundaries leading to social, temporal and spatial expansions influencing ordinary life.

Distinguished by the use of embedded GIS, LBMGs influence how people play, interact and perceive the city, by merging urban and virtual spaces into what has been termed 'hybrid realities' (de Souza e Silva, 2009; de Souza e Silva & Hjorth, 2009). These games include the location of players, transmitted through GPS signals, into the gameplay so as to include speed, heading and orientation (Winter et al., 2011). A player's avatar in the map-based virtual world corresponds to their geographical location, enabling particular interaction possibilities through the player's smartphone interface and in the physical city space simultaneously. These games, as with other mobile technologies, affect urban experiences encountered in cities (Colley et al., 2017; Hjorth & Richardson, 2017). Yet the question of how the design of the game interface and game components define the space of interactions (spatiality), patterns of movement through the city (mobility) and social interactions in urban spaces (sociability; de Souza e Silva, 2009), has not been clearly understood. This article uses the game Ingress as a case study of a collaborative LBMGs to understand how the design of the game mechanics/interface affects space and urban practices in the city. This study relates to the broader concern of understanding the spatial implications of digital mediation in geography (Kinsley, 2014).

Our argument and analysis is presented through the following logic. The following sections provide a selective review to position current debates on the mediating influence of mobile technologies in the city and hybrid spaces. After this, a new analytical framework relating game design to hybrid reality conceptual areas is developed. The case study is introduced through a brief description of the game and gameplay, before the analytical approach is applied. The article concludes with a presentation of the analysis and a discussion on game design and new interactions and practices.

2. Hybrid Reality Games and the City

The ever-increasing influence of digital devices and software on almost all practices such as work, leisure and travel has led to what is termed 'the digital turn' in geography. This has been categorised into geographies produced through, by and of the digital (Ash, Kitchin, & Leszczynski, 2018). While this categorisation is useful to understand how the digital interacts with the practice of knowledge production in geography (through the digital), relational space (by the digital), and virtual geographies/space (of the digital), the spatiality of mobile technology cannot be separated in this manner due to the blending of the virtual and the physical. A new logic of space, merging geographies of and by the digital space, or virtual and relational space, arise due to mobile technology (de Souza e Silva, 2009; de Souza e Silva & Sheller, 2014).

An increasingly popular lens to explore how new mobile digital technology influences urban behaviour and experience is based on the theories of 'digi-place' and 'code/space.' While the latter focuses on how code and space are mutually constituted, the former builds on this theory to explore how urban places are experienced through the mapping and ranking of information in cyberspace (Dodge & Kitchin, 2004; Kitchin & Dodge, 2011; Zook & Graham, 2007). Both are centred around how code 'transduces' space and discuss new hybrid compositions that merge the cyber and the physical. However, the emphasis here is placed either on the changing nature of urban place, through augmented urban experience, or on the production of space through code.

In contrast, de Souza e Silva's (2006) theoretical framework of hybrid spaces/realities examines space through the blurring of traditional boundaries between the physical and the virtual, as a result of the shift to mobile interfaces from static ones. This concept focuses on internet and GPS-enabled mobile technologies, which alter and create new forms of engagement and experience in cities, developing a unique lens to view and examine different digital interfaces. The concept of hybrid spaces is strongly related to urban gaming, specifically LBMGs or HRGs. De Souza e Silva (2009, p. 405) defines HRGs in the following manner:

> By creating a unique way of connecting players, and players to the play space, these games define a new logic of game space, which raise issues about our perception of urban spaces, the daily mobility through the city, and the relationship between serious life and playful spaces.

The three main characteristics utilised by de Souza e Silva to analyse HRGs in relation to urban interactions and experiences are spatiality, and through this, mobility and sociability (de Souza e Silva, 2009). The spatiality characteristic refers to the nature and logic of hybrid space or

reality that emerges from the mobile game/technology, and how this changes the interactions and experiences within, and of the city (de Souza e Silva, 2009). Mobility, as a new paradigm in urban planning, geography and the social sciences more generally (Sheller & Urry, 2006), looks at how players of such games change their patterns of movement and practice of travel in urban space by interacting with the game. The effect of LBMGs on movement and mobility have also been discussed in the context of Pokémon Go (Evans & Saker, 2019; Gong, Hassink, & Maus, 2017).

The sociability characteristic, building on the theory of urban sociability and ontology of play (Fink, 1974; Lehtonen & Mäenpää, 1997) examines the social interactions that are facilitated by the interface, movement and collective actions of players. The spaces that are (re)produced through mobile technologies, such as LBMGs, can be explored by analysing the digital interface through gameplay and observations of how players interact with the platform or game (Ash, 2015; de Souza e Silva, 2006; Manovich, 2001). For example, de Souza e Silva (2017) has used this approach to highlight how Pokémon Go lacks the sociability characteristic due to the lack of direct interaction between players as a result of the interface design. Ingress includes a different set of game mechanics, narrative and design that produces a different hybrid space with different effects on the city, which can be examined using a similar approach.

Within the context of the urban and spatial planning, the relevance of LBMGs lies in how such games change the practices of city dwellers, and how such platforms hold the potential to foster greater civic engagement and urban participation. As planning has evolved into planning as a 'reasoning process' through collaboration, so have the technology and tools utilised (Foth, Bajracharya, Brown, & Hearn, 2009). The potential of games in participatory planning practices, as new tools or technologies for reasoning and collaboration, has been debated and discussed extensively. In recent years, there has been an increasing trend towards using various forms of digital games for participatory planning (Ahlqvist & Schlieder, 2018; Gordon, Schirra, & Hollander, 2011; Poplin, 2011, 2014). These games are designed for community deliberation (Gordon & Manosevitch, 2011) and have typically been 'serious games,' or Public Participatory GIS (Gordon & Baldwin-Philippi, 2014; Poplin, 2011). However, such platforms have been criticised as one-off 'workshops' that are poorly designed and lack immersive and engaging features for creating ongoing involvement and engagement, and thus less effective than games designed for play (Gordon et al., 2011).

The specific challenge here is to understand how the design of the LBMG Ingress, a game not designed for planning, (re)produces a hybrid reality as an altered spatiality affecting the mobility and sociability of urban dwellers, and fostering engagement and participation, that 'serious games' in planning have not achieved. This requires a formal approach for the analysis of HRGs or LBMGs, breaking down game design components to examine how their mechanics (re)produce the hybrid space. To achieve the desired analysis we adapt the MDA analytical model from game studies (the Mechanics-Dynamics-Aesthetics framework) to cross-reference the essential and particular characteristics identifiable within HRGs. The following section provides additional details of the analytical approach utilised in this article.

3. Analytical Approach

A common analytical framework to examine how the specific design of mobile interfaces, particularly LBMGs, can affect urban practices and experience is non-existent in literature. An interdisciplinary approach to examining the digital interfaces, such as Ingress in our article, is necessary to bridge theories and methods of geography, social theory, media and cultural studies, and game studies (Ash, 2009, 2013). This follows a shift in emphasis across research on gaming more broadly, in which digital games are increasingly situated in relation to everyday practices and connections are drawn between game studies and a range of other disciplinary contexts (Apperley & Jayemane, 2012). In this article, we combine essential characteristics from the theoretical framework of hybrid realities with the MDA analytical model from game studies. This allows us to explore how the designed elements of our case study game affect the spatiality, sociability and mobility of players (engaged urban dwellers), through the hybrid reality enabled by the game.

The MDA analytical model was developed by Hunicke, LeBlanc, and Zubek (2004). This well-established framework aims to bridge the gap between game research, design, development and criticism (see Figure 1). The MDA framework has been previously used to demonstrate value and usefulness of existing games—by breaking them into analysable components—in the context of urban planning (Ashtari & de Lange, 2019).

From Hunicke et al. (2004, p. 1723), mechanics describes "the particular components of the game, at the level of data representation and algorithms," dynamics refers to "the run-time behaviour of the mechanics acting on the players' inputs and each others' outputs over time" and aesthetics refers to "desirable emotional responses evoked in the player, when she interacts with the game system." The aesthetics component of the model uses a dedicated vocabulary that includes: sensation, fantasy, narrative, challenge, fellowship, discovery, expression and submission. Each of the three components is used as a separate 'lens' to view the game but are causally linked.

In this framework, players experience the game through aesthetics as a result of the observed dynamics whereas the designer of the game experiences the game mechanics first when designing the system. The consideration of both perspectives, from mechanics to aesthet-

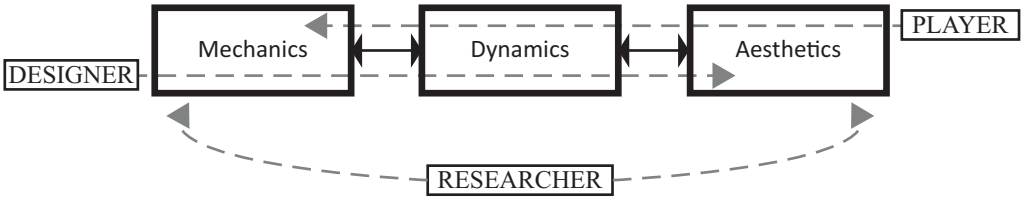

Figure 1. MDA model for game research, design and criticism. Source: Hunicke et al. (2004, p. 1723).

ics and vice versa, allows for research of the game to be undertaken. This model, when cross-referenced with the characteristics of hybrid realities (see Figure 2), presents a promising analytical approach for uncovering the 'black box' effects that game components might have on producing a new logic of hybrid space.

The methodology utilised follows visual research and observation methods that examine on-screen representations of how players interact with the game, other players, and the city (Ash, 2015; de Souza e Silva & Sheller, 2014; Rose, 2016). A qualitative content analysis method from visual research is used here to help us reveal and analyse patterns within the large quantities of observable data (Lutz & Collins, 1993; Rose, 2016) in the game.

Data were collected through immersion in the game over a three months period, with due attention given to covering different days of the week and different times of the day. Researchers participated as players in the game and conducted observations through this process rather than as non-participant observers. The three types of data collected are: (1) Notes on the game design, i.e., interactions with the game and through the game with other players and elements; (2) screenshots that were collected, processed and collated based on potential relevance to the conceptual areas of the hybrid realities theoretical framework; and (3) notes added to annotate the screenshots, making note of the various types of interactions and communication. The data were collected for gameplay interactions in Manchester, UK. The region provided sufficient gameplay activity due to the prevalence of culturally significant sites, corresponding to Ingress portals, and adequate population density. As resident researchers in the city, our direct involvement in gameplay interactions was possible.

The analytical process involved coding the data to categories identified in the proposed analytical framework. The framework combines a hybrid realities theoretical framework and the MDA analytical model. The resultant analytical matrix (see Figure 2) presents an opportunity to cross-reference two frameworks, to relate the designed elements of mobile game interfaces with characteristics of and enabled by hybrid reality spaces. This perspective enables bridging of theory and game design based on qualitative observation and coding rather than quantitative approaches based on game statistics, interviews or surveys. It is worth noting that, while examining the effects of the Ingress interface on the city and its dwellers is the aim of this article, technological determinism is not assumed. i.e., users are not reduced to 'puppets' that are influenced solely by the game mechanics (Ash, 2015, p. 9). This study positions technological advances against possibilities for changed behaviour.

As part of a multi-stage process, we initially position MDA based observables in relation to actions, behaviours and experiences of players within the new logic of the hybrid space (spatiality). A second step relates mobility and sociability of players—as urban dwellers—to the space of the city. The MDA analytical framework as incorporated in this approach requires a specific interpretation for use with LBMGs. Here, mechanics are considered to be the intentional design features of the game built around communication and

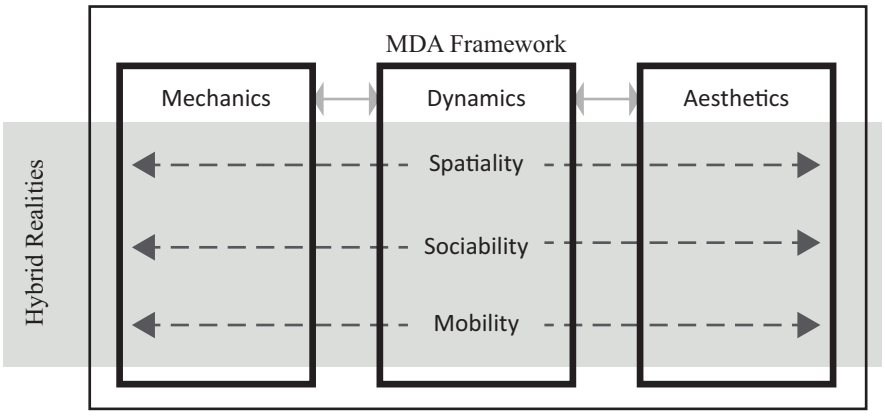

Figure 2. Analytical model combining the MDA model and hybrid realities theoretical framework. Source: Hunicke et al. (2004) and de Souza e Silva (2009).

movement opportunities. Dynamics refers to the use of specific game design features contributing to individual or collective run-time behaviours. Aesthetics is based on gameplay incentive, i.e., what allures the players to play Ingress in the urban setting in specific ways.

4. Case Study: Introduction to Ingress

Ingress was launched in 2013 and presents an exemplar case study of collaborative LBMGs for several reasons. Ingress' game design embeds components for collaboration and socialising that are unique and different when compared with other LBMGs (Lee, Keating, & Windleharth, 2017). Ingress had over 20 million global players according to reports by Niantic—the Ingress game developer owned by Google—in November 2018 (Niantic, 2018). Within the game, a 3D map-based virtual world that corresponds to real-world geography is interacted with through the interface to facilitate play. This gaming platform uses GPS location information from smartphones, Google Maps, and Google points of interest (POI) to bridge urban and virtual spaces. Players move through the physical environment of the city and their avatar in the game moves accordingly in the virtual Ingress environment that is visible to them through their smartphone screens (see Figure 3).

4.1. Game Narrative, Aims and Infrastructure

The game narrative is developed around an alien resource called Exotic Matter (XM). Players of the game are split into two factions: The Enlightened, who believe XM will help to enlighten humanity; and the Resistance, who believe XM enables an alien entity to control human minds. Both factions are composed of real-world players who choose which faction to join. The opposing ideological factions seek to capture virtual 'portals' to control virtual geographic areas and prevent the other faction from taking control of the city. Portals are mapped to real-world heritage or cultural POI such as public works of art, landmarks, parks, etc. (Niantic, 2018). By linking portals together through a triangulation process, the competing factions can take over geographical areas to create 'mind fields' that can either enlighten the human population below (Enlightened) or protect the population from the threats of mind control (Resistance). Mind fields vary in sizes and can span across cities, countries and borders. The XM material is scattered across the city where

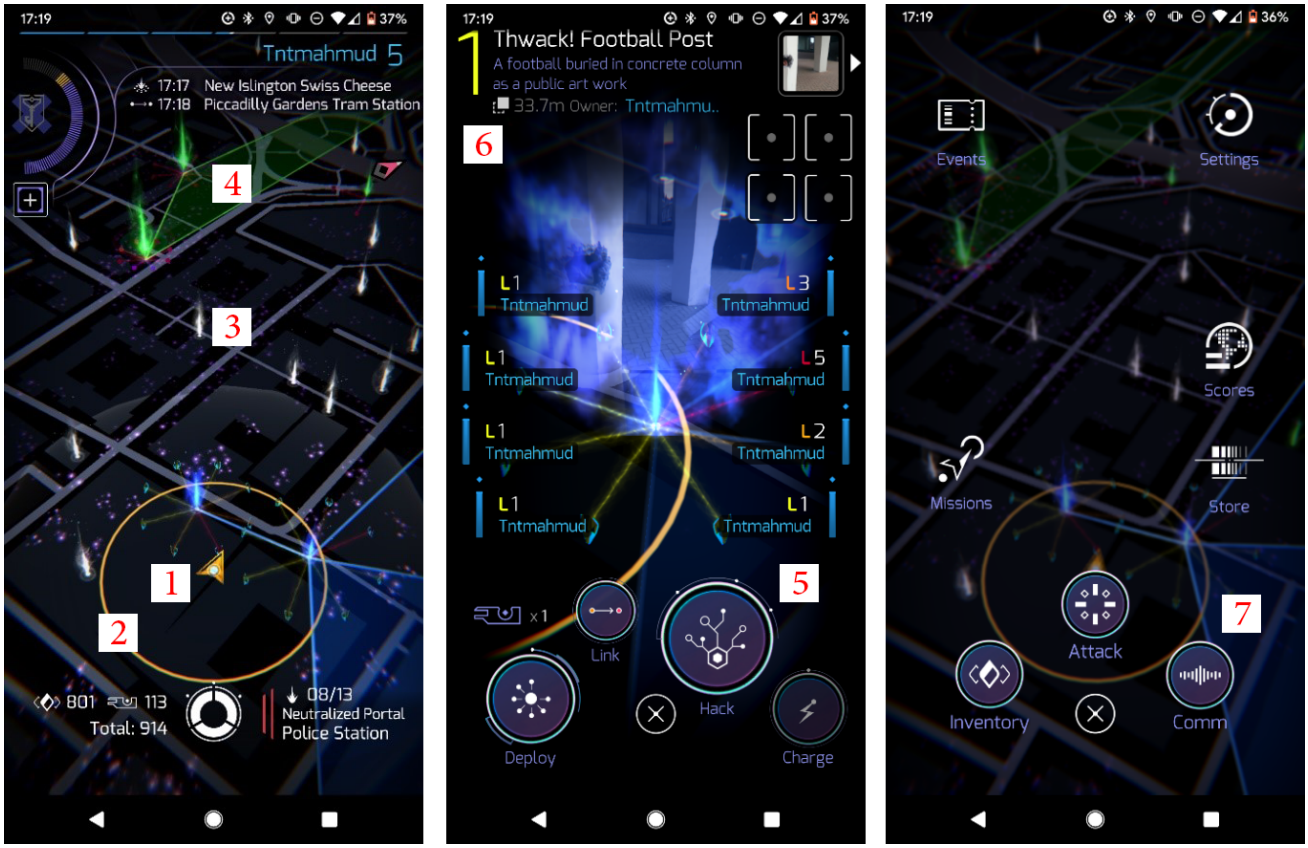

Figure 3. From left to right: Ingress 'Scanner' phone app for locating and collecting XM and portals; the status of portals and the real-world POI they correspond to—in this case, the 'Thwack!'; gameplay features such as communications, attacks, global scores, inventory, missions and events. Notes: (1) player's avatar, (2) gameplay interaction radius, (3) portals, (4) mind fields, (5) portal hack and deployment interface, (6) portal status and info (7) communication channel. The green portals or mind fields are captured by the Enlightened, and the blue portals or mind fields are captured by the Resistance.

players can collect them to power weapons to attack or defend portals.

The main aim of the game is to control as much of the city as possible to alleviate the threat of control from the rival faction. Players play the game through their smartphone Ingress app, which acts as a 'Scanner' of XM material and portals embedded within their surrounding area. Players use this interface to attack and capture the opposing faction's portals and mind fields or defend and protect their own. The XM scanner app provides immediate contextual information related to portal capture or attack. To see the bigger picture of how the battle is unfolding, players use the Ingress Intel map (see Figure 4). This Intel map provides the players with a top-down view to coordinate and plan strategic attacks from a desktop internet browser. Ingress facilitates collaborative multiplayer play by providing communication channels and events where the Ingress urban communities can gather and exchange information for field operations.

Ingress' gameplay run-time behaviour enabled through the game mechanics is driven by a digital data environment or infrastructure. This is comparable to the digital skin of cities (Rabari & Storper, 2015) in that this big data environment constructs a virtual city or reality. This also exerts influence on how urban mobility and sociability are impacted through the hybrid spatiality of the LBMG. The game designers, through unknown processes, provide a baseline top-down positioning of portals. However, players can also suggest new portal locations, comment on, rate and volunteer their local knowledge by describing and rating real-world POI that correspond to portals in the game (see Figure 5). This enables the possibility for an evolving game board through bottom-up processes between players and Niantic, who consider proposals based on their published guidelines for approval and portal criteria. The 'Wayfarer' tool introduced in October 2019 enables players of a certain level to nominate, peer-review and rate portals and places. In addition, Missions, a feature added in 2014, facilitates players suggesting and collaborating with others on missions by specifying certain times and portal tracks, or waypoints, to visit and interact with in specified ways. In order to keep the players up to date with the latest changes, Niantic publishes guidelines and offers support through their website for portal and other gameplay features (Niantic, 2020a).

5. How the Design of Ingress Affects the Logic of Hybrid Spatiality and Links to Urban Mobility and Sociability

The analytical approach used in this research enables grouping of mechanics, dynamics and aesthetics within the game design as drivers of gameplay logic and player interaction through the (re)production of hybrid 'spatiality.' This section presents observable links between the virtual interactions, urban mobility and sociability in the physical and social spaces of the city. It should be noted that hybrid realities necessitate an inseparable understanding of virtual and city spaces and that attempts to extricate the two to observe the impact of one on the other is difficult due to their intertwined nature. Each section presents the findings of the MDA model as applied to each of the hybrid reality characteristics (see Figure 6).

5.1. The (Re)Production of Hybrid Reality Game Space (Spatiality)

The spatiality of the game is shaped by the mechanics designed into it, along with the dynamics and aesthetics that emerge from the gameplay. The specific combi-

Figure 4. Screenshot of Ingress Intel map showing the aggregate outcomes of the battle for portals in the West and East Midlands region of the UK.

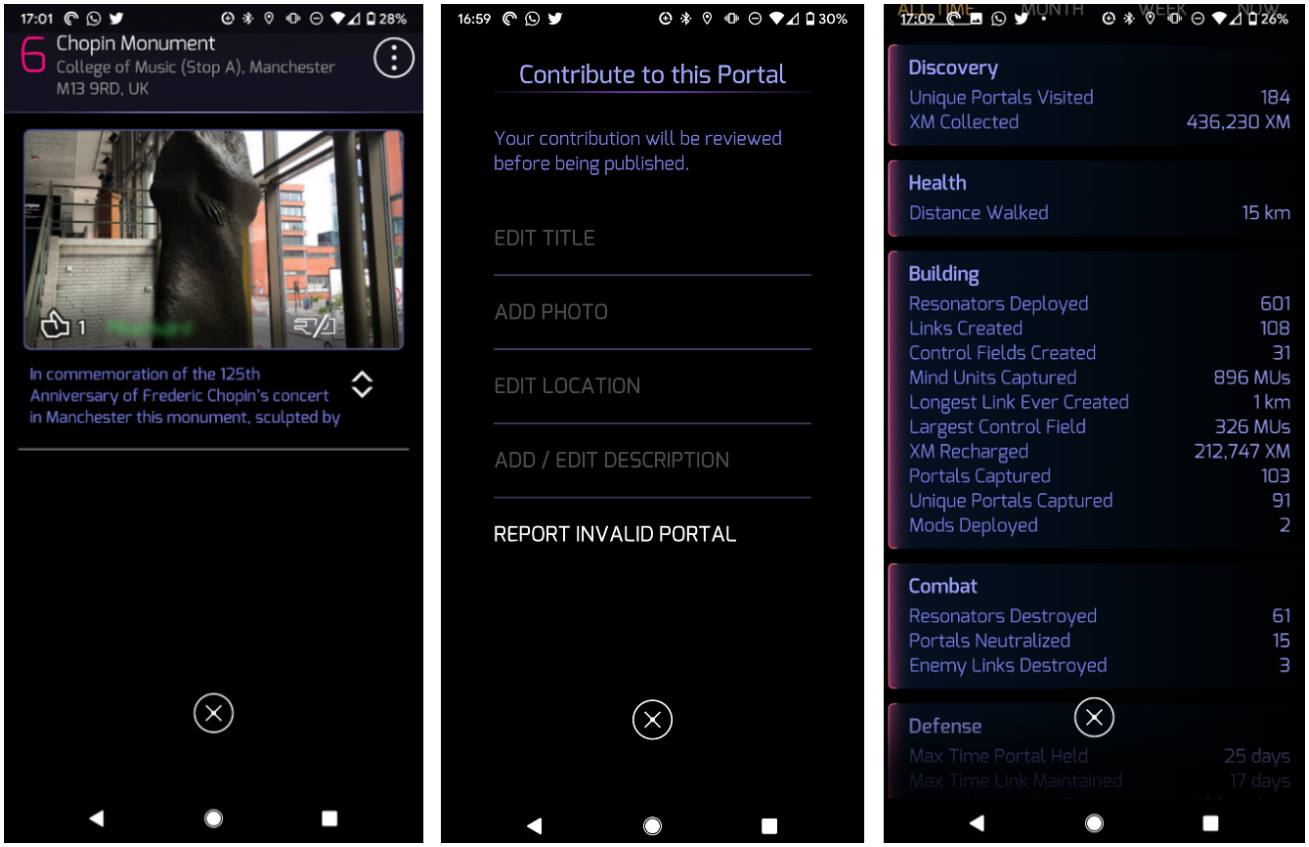

Figure 5. From left to right: Ingress' volunteered portal information from smartphone application—portal local knowledge contribution, rating and POI Images; portal contribution interface; player gameplay history and data.

nation of elements constituted under these categories defines the unique hybrid reality game space and the ways in which players interact with it and in it.

The most significant game mechanics (components, data representation, algorithms) contributing to this spatiality have been observed to be:

Mechanic 1: The co-existence and co-location of virtual and city spaces and game elements (portals/territories) creates a hybridised experience of the city.

Mechanic 2: The ability for players to change the game board bottom-up through proposals of new virtual elements and supporting information about the physical spaces these will be associated with.

Mechanic 3: The locally limited and live augmented experience of the proximity scanner allowing interaction with other players and virtual game elements within a player's immediate vicinity, while on the move.

The primary contributing game dynamics (the run-time behaviour of the mechanics acting on the players' inputs and each others' outputs over time) observed are:

Dynamic 1: The aim of territorial acquisition within the hybrid spatiality of the game alters the reading of the physical territories of the city, by layering them with altered values and qualities related to assumed control and need for strategic location-based actions.

Dynamic 2: Contribution of local area knowledge in support of virtual elements constantly changes the game board. There is an ongoing process of city information being (re)produced within the virtual game board as players can directly contribute local knowledge of POI and local heritage, more closely aligning the material and the virtual. This process of 'knowledge contribution' is what Winter et al. (2011) refers to as spatial knowledge acquisition of LBMGs and can also be considered a form of Volunteered Geographic Information (VGI; Goodchild, 2007).

Dynamic 3: Augmentation of unexplored virtual spaces in the game creates an impetus for players to explore and play previously unexplored spaces in the physical city. The dynamics of mapping and rating transforms how places in the physical city are perceived and navigated (Zook & Graham, 2007).

The aesthetics (desirable emotional responses evoked in the player when interacting with the game system) observed related to the formulation of the game space are:

	Mechanics	Dynamics	Aesthetics
Spatiality — production of hybrid space in relation to urban experience and practice	1) Co-location of real physical spaces and virtual game elements (portals/territories) creating a virtually augmented physical experience of the city 2) Bottom-up portal suggestions, comments, ratings and contribution of local knowledge 3) "Scanner screen" smartphone application	1) Altering the reading of the physical territories of the city, by layering it with altered space qualities as a result of the territorial acquisition aim of the game 2) Ongoing process of real city information being altered within the virtual environment as players can directly contribute local knowledge of POI and local heritage 3) Augmentation of new unexplored virtual space onto the urban space changing the urban experience and generating impetus for exploration	1) **Challenge** of capturing important territories and active engagement 2) **Discovery** and contribution of city knowledge cultivated through sense of useful contributions 3) **Sensation** through the accidental encounters and live competitive game play
Sociability — social interaction related to playfulness, experience, unpredictability and surveillance	1) Channels for within faction and cross-fraction communication affected by distance 2) Incessant 24/7 gameplay possibilities and game alerts	1) Encounters through tactical and collaborative gameplay, development of new social networks, external social media groups and physical meetings in the city 2) Continuous gameplay opening up possibilities of co-ordination with other daily practices and spontaneous interaction with the game throughout the day	1) **Fellowship** through collaboration to achieve common gameplay objectives 2) **Sensation** of unpredicted urban social encounters and continuous gameplay
Mobility — patterns, mode of transport and experience	1) Avatar movement in virtual and real space to capture and link portals with decay function 2) The Intel Map: dashboard-like gameplay data display with incorporated communication channels	1) Players move through the real city in order for their virtual avatars to capture virtual portals or otherwise interact with game 2) Dynamics of strategic collective movement and communication informed by desktop intel map and filters	1) **Fantasy** of role playing that drives collaboration 2) **Narrative** of two opposing factions impacts on the mobility practices in order to gain competitive advantage

Figure 6. Results of applying the new analytical matrix, combining hybrid reality categories and MDA.

Aesthetic 1: The continuous challenge of capturing and retaining control over territories drives the engagement between players and the game. It engages players with the combined virtual and physical space of the game and the city in a process that does not stop when players are not actively partaking in the game. Hence, the territory of the game board is dynamic and requires active engagement.

Aesthetic 2: Discovery—through uncharted territory—of new elements and a sense of useful contribution, cultivated by allowing players to re-assert their values and meaning of place into the game, when in accordance with Niantic's guidelines and standards. Here research of the physical city, POI such as works of arts or landmarks and local knowledge, have a role in a player's ability to contribute to the evolving game board.

Aesthetic 3: The sensation—changes to the urban experience—of seeing the actions (not location) of local players amongst other game elements creates a sense of accidental encounter, intimacy, excitement and live competitive gameplay, making the hybrid game space dynamic at a personal scale. A parallel and reframing of this sensation as 're-enchantment' can be found in other LBMG studies (Fragoso & Reis, 2016; Klausen, 2014).

5.2. New Opportunities for Sociability

The particular spatiality of the game results in specific types of observable sociability within the hybrid space but also spilling over into social practices within the city.

The observable game mechanics encouraging and/or enabling specific aspects of sociability are:

Mechanic 1: The availability of channels within the game for communication with other players of your faction and also from the opposing faction. The filtration of these communications based on current geographical location and distance play a role in centralising the importance of immediate locality and proximity to others.

Mechanic 2: The incessant nature of the game running and changing no matter whether a player is actively engaged or not, alongside alerts that appear on the player's smartphone even when the Ingress app is not open, results in an overlap with the time and space of other daily practices.

The transmutation of space within Ingress occurs partially through player interactions and hence is not wholly controlled by either the game designer or single players, affecting sociability dynamically and unpredictably. In the context of this, the observed dynamics of the game driving aspects of sociability are:

Dynamic 1: The tactical and collaborative nature of the game, which results in the creation of additional social networks, external social media groups and even physical meetings in the city. As a demonstrative example, while participating in the game, the authors were invited to and joined a group on Google Hangouts with 91 players from the local area. Such groups were observed to be commonplace based on observable discussions on gameplay operations. The authors were also invited to virtual teleconferencing events that took place over zoom, where players could choose to be identifiable to each other, and sometimes undertake quizzes.

Dynamic 2: The continuous gameplay means that players are not involved in a binary on/off situation, but rather scale their input based on the possibilities of co-ordination with other practices and spontaneously interact with the game throughout the day. Collaborative LBMGs, in this case, reinforces Montola's (2005) argument of the 'expanded magic circle of play,' where the boundaries between play and everyday become less defined.

The aesthetics observed in relation to sociability are:

Aesthetic 1: The growth of fellowship, through the development of faction identities and relationships (friendly and adversarial) originating from the gameplay, towards achieving common collective goals through strategic collaboration. The player-to-player interaction enabled by locality and distance link to sociability in relation to playfulness, unpredictability and surveillance (de Souza e Silva, 2009). The playfulness of the game gives rise to social and spatial negotiation leading to competitive and unpredictable behaviour, and the surveillance or monitoring of how others are playing the game. From our case study, an anecdotal example of sociability was observed when a certain player was observed challenging players from the opposing faction regarding control over a certain locality. The communication between the players involved playful invitations and challenges such as "you can try if you can." The attacking players coordinated their attempts to acquire the territory but eventually failed. This interaction eventually raised suspicions for the losing faction leading the attacking players to ask "have you got 2 accounts?," which was confirmed by the defending player that stated "ha ha ha, ya seen me." The observed behaviour of players involved unpredictability, surveillance of the other and playfulness.

Aesthetic 2: The associated sensation—the experience of virtual game elements augmenting the real world—of sociability as a result of the fellowship aesthetic is a particular strength of Ingress, in addition to the surveillance of other player actions on screen and sometimes physical encounters, contributes to the sensation of playfulness and unpredictability as we have observed. As mentioned previously, our observations also found that the design of ingress fosters unique collaborative gameplay and socialising elements (Lee et al., 2017).

5.3. Entangled Digital and Physical Mobility

The spatiality of the LBMG requires players to move through the physical space of the city, and collaborate on strategic objectives in order to achieve goals.

The two most significant game mechanics related to the mobility of players are:

Mechanic 1: The avatar of the player within the virtual game environment mirrors the movements and location of the player in the material physical environment. This means that playing the game actively requires movement through the city.

Mechanic 2: In addition to the mobile interface on the smartphone, there is also a desktop Ingress Intel map of the unfolding gameplay providing a big picture of the state of play. Players use this top-down view to coordinate and collaborate multiplayer movement towards the achievement of strategic goals.

The main game dynamics affecting mobility in the city are:

Dynamic 1: Players move through the physical spaces of the city in order to capture virtual portals with their virtual avatar or otherwise interact with the game. The portals have a decay function, meaning that players have to repeatedly visit their locations to main-

tain and charge them. This aspect has an impact on the mobility patterns of the players, who often seek to capture or defend portals and mind fields around their residential or work localities. The prevalence of this territorial behaviour was clear in our observational data. Players, in a number of examples, communicated or observed other players living or working in the neighbourhood by the number of portals they had captured. The player pseudonym for captured and maintained portals are visible to other players (see Figure 3). Players were often observed to post messages such as "yea, I only live around the corner from the library" to build local networks for tactical advantage. However, players also go beyond their work and home localities to participate in collective attacks with other players of the same faction when deemed strategically necessary. In addition to this, game missions suggested by players themselves challenge other players to seek out culturally significant sites that go beyond their familiar localities.

Dynamic 2: The desktop-based 'Intel map' allowing overviews of the wider state of play incorporates various levels of data aggregation and tools to filter and analyse different situations. The communication channels to locally relevant players result in the dual dynamics of strategic collective movement of multiple players in the city and the reality of them navigating the immediate built environment and available modes of transport. The differences between the phone and desktop screens are shown in Figure 3 and 4 respectively. A player's mode of travel affects both patterns and speed of movement. Players on foot have more local travel patterns and can go into parks and places where cars cannot, while travel by car allows for speed and distance, but is restricted by city infrastructure.

The game aesthetics affecting mobility are:

Aesthetic 1: The simulated fantasy—the make-believe factor—of a greater purpose based on collective endeavour playing a role in mobility patterns of players and the motivation to undertake trips to achieve collective goals.

Aesthetic 2: The rivalry created by the game narrative—the drama of gameplay—of two opposing factions impacts on the mobility practices of players as they competitively change locations in attempts to alter the geometric on-screen representations of mind fields that are the measure of winning or losing the game. Several observable examples illustrate the dynamics driven by portal locations and aesthetics leading to both unpredictable and organised urban encounters. Players from cross-factions could be observed to challenge each other through the communication channels provided within the game to battle over certain portals/areas. Subsequent communication through these channels also highlighted accidental encounters in the city with "was that you…" messages. Online adverts also elude to these 'accidental' encounters (Niantic, 2020b)

6. Discussion

This section discusses the key game mechanisms, their effects and altered practices in the city. The observations in the previous section illustrate how game design affects the behaviour and experience of players. The analytical approach also allows the identification of key mechanisms affecting gameplay, leading to altered practices in the city. The primary areas of impact identified are (1) altered perceptions/readings of the city and (2) altered engagement with the city. These, in turn, lead to altered practices in urban movement and social collaboration.

Ingress has incorporated a potent combination of innovative mechanisms based on a wide range of possibilities for LBMGs. Its hybrid spatiality co-locating material and virtual elements in the city blurs the game space and the space of urban practices in such a way as to make them interrelated and entangled as suggested by de Souza e Silva (2009) and Montola (2005). The city is perceived through a constantly changing digital skin (Rabari & Storper, 2015), which creates (re)readings of territory and associated activities related to territorial acquisition. The ability for players to propose game elements and support these through the provision of information about physical spaces in the city provides a bottom-up process for VGI, incentivised for players attempting to redefine the game board. A flow of information between the digital and city spaces increasingly aligns them, blurring the boundaries and making them part of the hybridised space. This process contributes to exploration and discovery in the city by making new and additional information about known and unknown places available to the players. The mechanisms for communication and collaboration between players opens up a new dimension of strategic and spatial possibilities for engagement with fellow urban dwellers. The incessant nature of the game results in an increased integration between game time and time dedicated to other everyday practices. Other studies on Ingress have also confirmed this finding in terms of an 'interlacing' with urban life in different ways (Fragoso & Reis, 2016). The game can be played spontaneously, based on a combination of the location of the player in the city and the need to react to changing conditions in the game.

Altered mobility practices based on engagement with the game can range from minor route alterations on everyday commutes to designated multiplayer excursions towards achieving specific collective objectives. The mode choice for travel and the experience of journeys themselves are affected by the restrictions of the former and the need to physically move through the city in order to make one's avatar move in the virtual interface.

Altered social practices resulting from the need to align with a faction and work collaboratively to achieve game goals has resulted in the development of external social media-based and physically located networks, which are reinforced through local events, missions and challenges encouraging collective action and differentiated roles.

As a counterpoint to the apolitical analysis of the potential for LBMGs to alter urban practices and facilitate collaborative possibilities, it should be noted that previous research into the case study of Pokémon Go has found that its design reinforces geographic inequalities (Colley et al., 2017), pointing to LBMGs and the need to study their wider effects on the city in this context (de Souza e Silva, 2017; Hjorth & Richardson, 2017). Concerns related to issues of privacy and surveillance in LBMGs have also been raised. Ingress, specifically, has been labelled a game promoting "datafication in exchange for the gift of play," and has been claimed to exploit gamer communities being dubbed one of the most seductive and "prolific data-mining tools to be introduced in the last decade" (Hulsey & Reeves, 2014, p. 389). The focus of the analytical framework utilised here is on the use of gameplay mechanisms in producing a hybrid gameplay environment with impacts on social and mobility practices, and engagement with the city, resulting in limitations for direct analysis of political aspects, limitations or bias. An alternative framework could perhaps be better suited to overcome this limitation.

7. Conclusion

Mobile communication technologies in cities are increasing, affecting everyday life through the mediation of urban experiences and interactions (Ash, 2015; Castells, 1996; Manovich, 2001; Rabari & Storper, 2015). The practice of playing Ingress is related to multiple altered urban practices including: mobility in the city, engagement with places, new social networks and collaborative actions. The analytical approach utilised allows the identification of specific mechanisms incorporated into the digital interface and overall game design enabling avenues towards these changes. With the prevalence of LBMGs, the new and altered possibilities for multidimensional interactions between players and the city are relevant for urban management and governance (Rabari & Storper, 2015; Sengupta, 2017). The increased levels of participation, collaboration and engagement achievable through the intentional design of digital interface components provide possibilities of scale, participation and immersion that 'serious games' in planning have not managed to achieve (Gordon et al., 2011). Lessons can be learnt from Ingress and other HRGs regarding the use of new digital technologies and platforms for awareness, co-evolution, participation and negotiation, in the context of emergent urban futures (Sengupta, 2017).

This article introduces an innovative interdisciplinary approach that can be used to deconstruct LBMG interfaces into analysable components and theorise their effects on urban practices. We have demonstrated the utility of this approach, for comparative studies on other LBMGs and their effects on urban practice. Other issues such as privacy and power relations raised around LBMGs have been largely unaddressed in this article due to its focus and scope, but remain significant and point to additional dimensions of research in this context. The methodological approach taken partly reflects limitations posed by the lack of a formal Application Programming Interface for Ingress at the time of writing. The availability of this feature in the future should allow additional insights through digital traces in the city, and help develop a better understanding of privacy issues. An alternative approach utilising mobile technology data to explore urban community dynamics using GIScience methods can be seen presented by Shelton, Poorthuis, and Zook (2015). A further methodological approach would be to interview and access the developers of LBMGs such as Niantic in our case study, which may help reveal some of the underlying motivations behind the game design. These alternatives, among other approaches, would be complementary to the approach taken in this article and can shed further light on spatial inequalities, how practices of the urban gamers have changed, data privacy, VGI processes, power relations and negative consequences of LBMGs which are beyond the scope of this article.

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Conflict of Interests

The authors declare no conflict of interests.

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About the Authors

Ulysses Sengupta is a Reader at the Manchester School of Architecture (Manchester Metropolitan University). Sengupta is the founding director of the Complexity Planning and Urbanism research laboratory [CPU]Lab and leads the master's design atelier [CPU]Ai. He uses a complexity framework for transdisciplinary research between design, natural and social sciences. This involves new digital tools, computational thinking and urban theory addressing urban transformations. His research spans future cities, smart cities, the Internet of Things, agile governance and cities as complex adaptive systems (CAS).

Mahmud Tantoush is a PhD candidate at the Department of Architecture and researcher with the Complexity Planning and Urbanism research laboratory [CPU]Lab at the Manchester Metropolitan University. His PhD research analyses and links Volunteered Geographic Information and other forms of urban data to understand how cities function in relation to urban morphology on different temporal and spatial scales. His interests lie in computational design, smart cities, big data, geographic data science, urban morphology and complexity theories.

May Bassanino has over 15 years' experience in conducting and delivering interdisciplinary projects in the areas of collaborative engineering, process modelling and evaluation frameworks. This expertise has been applied to a variety of domains including construction, ecosystem, social, design and energy. May joined the Complexity Planning and Urbanism research laboratory [CPU]Lab at the Manchester School of Architecture (Manchester Metropolitan University) as a Project Manager and Researcher in 2019 and has been working in the area of urban complexity research since then.

Eric Cheung is a fully qualified architect in the UK and a Researcher at the Manchester School of Architecture (Manchester Metropolitan University). His research attempts to answer old problems with new methods for urban-transport integrated spatial design and planning, drawing on and contributes to known theoretical frameworks and new computational techniques. This involves the investigation and construction of advanced computational methods and tools to understand urban-transport systems and to explore the multi-dimensional decision space for alternative spatial solutions.

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Article

IT-Oriented Infrastructural Development, Urban Co-Dependencies, and the Reconfiguration of Everyday Politics in Pune, India

Aditya Ray

Faculty of Social Sciences, The Open University, Milton Keynes, MK7 6AA, UK; E-Mail: aditya.ray@open.ac.uk

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Abstract
Existing scholarship on postcolonial urbanisms has judiciously analysed the role played by the state and private capital in the expansion of global information-technology clusters and exclusive high-tech knowledge enclaves that have emerged across different metropolitan fringes in India and in the wider global South. However, much of this scholarship has focused primarily on the antagonisms wrought by the 'expulsion' of local rural populations from their lands and livelihoods, at the hands of the neoliberal state and global capitalist elites. In contrast, there is not enough research on how diverse local communities and subaltern actors emerge in place, and help organise, support and sustain these modern infrastructural spaces well after the initial moment of their establishment. Citing this important gap in our knowledge, this article argues for the need to move beyond some of the adversarial accounts associated with the overarching logics of postcolonial capitalist accumulation and new suburban development in the global South, to focus instead on the complex 'afterlives' of these modern high-tech suburban spaces. Drawing on ethnographic data from Pune city in Western India, and an emerging IT and IT-enabled services (IT and ITeS) outsourcing hub, the article reveals that contrary to popular perceptions of high-tech clusters as sovereign spaces for transnational capital, these sites are, in fact, constitutive of their multiple 'outsides'—which include diverse forms of informal and illegal economies and labour. To evidence these claims, the article highlights different examples of 'urban co-dependencies' which have in situ emerged in Pune's new urban fringes, to meet the growing gaps in demand of essential public services in these areas. The article then proceeds to show how Pune's local micro-political cultures, including the numerous instances of territorial conflict and collaboration between so-called elites and subaltern actors at the local level, continue to 'co-shape' the typologies and the temporalities of local land use, planning and development that takes place in India's new urban fringes.

Keywords
critical urban theory; digital geography; global South; high-tech agglomerations; neoliberalism; postcolonial urbanism; urban co-dependence; urban informality

Issue
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1. Introduction

Recent scholarship on digital geographies addressing the growing pervasiveness of 'the digital' in everyday life has come to acknowledge the need to expand its focus from digital objects and subjects towards a broader understanding of its mediation by social power relationships and inequalities "along lines of race, gender, class, sexuality, age, etc." (Elwood & Leszczynski, 2018, p. 630). Thus, apart from exploring material infrastructures that enable digital practices and specific kinds of data and knowledge production, conversations on digital geographies increasingly include "the spacetimes and socio-spatial relations produced through increasing digital mediations of everyday life" (Leszczynski & Elwood, 2018, p. 631; Shelton, Poorthius, & Zook, 2015). These conversations have, in turn, led to new conceptualisations of the contemporary city through its 'digital skin' (Rabari & Storper, 2015), understood not just through cities' physical infrastructures, but also through "their social and material forms, component resources, and as sites of creation and disposal" (Ash, Kitchin,

& Leszczynski, 2018, p. 28; also see Lepawsky, 2014; Zook, 2005).

This article attempts to further expand the discussion on contemporary digital geographies by exploring the interaction of modern digital infrastructures with uneven urban development and planning in cities of the global South. At the centre of its enquiry are the IT/IT-enabled services (ITeS) sector oriented high-tech clusters in Pune city, an emerging tier-two metropolis, near Mumbai in Western India. These high-tech clusters contain numerous large technology parks or knowledge enclaves, which have become hotspots for the IT and ITeS outsourcing in the region. Over time, these clusters have seen new commercial and residential developments around them, considerably altering the wider landscape of the city's suburban fringes.

The rise of high-tech urban clusters in India has been associated with post-economic liberalisation policies that permitted the state—and later private companies, as well as public–private partnership ventures—to punitively acquire large tracts of land from peri-urban and rural communities and facilitate the establishment of special economic zones and export processing zones with world-class, modern amenities, infrastructural facilities and substantial regulatory and tax concessions (Chatterji, 2013; Cowan, 2018, p. 1247). The primary aim behind the establishment of these large, fortified infrastructural spaces was to attract new foreign capital investment in the metropolitan fringes and satellite towns, "providing an internationally competitive and hassle free environment for exports of goods and services" (Topno, 2005, para. 1), insulating it from the quagmire of statutory regulations and interruptions to everyday life outside.

Ayona Datta (2015), writing on new smart-city developments in India, mentions that modern high-tech infrastructural urbanisation in India can be uniquely understood in two interlinked phenomena: First, as the continuation of an earlier project of postcolonial modernisation of the Indian state, aimed at creating self-contained or autonomous towns (Kalia, 1990) and, second, as the outcome of the "global phenomena of privatisation of urban spaces" (Hogan, Bunnell, Pow, Permanasari, & Sirat, 2012, p. 59), broadly associated with the advent of postcolonial urbanism and new models of neoliberal urban governance (Robinson, 2014; Roy & Ong, 2011) that idolise globally integrated but locally disarticulated 'archipelago economies' (Veltz, 2000), as key sites of new economic growth in developing nations such as India. Both explanations highlight the growing domination of postcolonial capital and transnational elites in urban planning and development and their role in producing hyper-exclusionary and unequal landscapes of new urban India through the violent displacement and dispossession of local landholding classes and of landless labour communities (Cowan, 2018; Sanyal, 2007).

Rather than tracing the genealogy of new high-tech urban clusters in suburban India and their evolution into private enclaves of globalisation, this article instead conceptualises them as spaces that are constitutive of "a multiplicity of normative orders" (Mezzadra & Neilson, 2019, p. 152). In other words, instead of viewing high-tech urban clusters as sovereign economic enclaves, free from techno-bureaucratic interruptions and "'annoyances' of everyday urban life" (Datta, 2015, p. 4), this article identifies them as spaces of global production and exchange that are, nonetheless, mediated by local economies, infrastructural services and actors with varying degrees of formality, legality and permanence. In doing so, the article emphasises the need to emplace these new urban infrastructural spaces within notions of urban co-dependencies that emerge in place, and that get moulded by spatial contestations and collaborations between different elite and subaltern urban actors.

The structure of the article is as follows. The next section reviews the conceptual literature relating to IT-oriented urbanisation in India's megacity fringes, specifically focussing on the overarching class (capitalist vs. agrarian) and spatial (global vs. local) binaries that frame some of the key discussions in literature on postcolonial urbanisation in India and the wider global South. The section argues for the need to move beyond these binaries, to explore the vibrant afterlives of high-tech suburban clusters by understanding and exploring their continuous co-shaping by diverse, yet co-dependent local economies, infrastructures and civic and political actors. In the third section, the article introduces the reader to Pune city and its transforming suburban context in which this research is rooted. The fourth section, comprising of the first key discussion segment of this article, illustrates the various dimensions of Pune's IT/ITeS-oriented new suburban growth and its increasing dependence on the different forms of informal and illegal (shadow or grey) economies in the city, in the context of local access to various basic infrastructural-services such as transport, housing, water and food. This section finds that these diverse economies have become a huge and indispensable part of the city's fabric, establishing urban co-dependencies that are integral to the sustenance, growth and transformation of new infrastructural spaces in the city's fringes. The fifth section delves into the various urban actors and interest groups involved in the different territorial negotiations, contestations and collaborations in Pune's new urban fringes. Through different examples, this section highlights how the establishment of high-tech clusters has transformed the modes of everyday participation for these actors, with predictable intra-class and less predictable cross-class coalitions emerging locally in the context of these new spaces. The article then summarises the key conclusions based on the discussion.

2. IT-Oriented Urbanisation in India and Its Contradictions

Existing discussions on the rise of new IT-oriented urban development in India's metropolitan fringes encom-

pass two inter-connected antinomies that are hotly debated. One underscores the movement from public-focused to private-led urban planning in these 'emergent' spaces (Chatterji, 2015), while this highlights the relative sovereignty of these new infrastructural spaces fringes, from local social, bureaucratic and democratic constrains (McFarlane, 2010). Both sets of discussions emphasise the emergence of the overarching logics of mainstream global urbanism 'from above' in the global South, which "organise urban development around neoliberal norms" (Sheppard et al., 2015, p. 1947), and ultimately produce new socio-spatial divisions in the local context, layered over earlier ones.

2.1. Emergent 'High-Tech Clusters' and Bipolar Spatial Development: Of Gurgaon and Beyond

A common example from India, often cited in literature, that amalgamates both antinomies associated with neoliberal suburban development, is Gurgaon—the country's foremost 'millennium city' and IT/ITeS exports hub, located just outside the national capital of Delhi. Gurgaon was primarily developed by large, private-sector investment companies with the help of the state; this was during the new "property development-led laissez-faire regime of urban development" (Chatterji, 2015, p. 165) in the economic liberalisation era that began in the early 1990s. This meant that while private planning was given a dominant role in urban development, public and participatory modes of planning in new suburban fringes were missing, or an afterthought at best. This stood in contrast to established cores of India's metropolitan cities, where planning continued to be largely the prerogative of the state and its local, decentralised institutions of urban governance (Goldstein, 2016). Today, Gurgaon's many IT-park clusters and associated commercial and luxury housing blocks are viewed as futuristic private islands, situated amidst the proverbial sea of vacant agricultural lands and rustic urban villages with poor public infrastructural access, and communities which have been left without proper compensation or decent jobs and livelihood opportunities. This 'bipolarity' in Gurgaon's spatial development is further evidenced by the fact that while it has achieved global recognition as one of the top destinations for the internationally offshored IT/ITeS services in the world, it nevertheless continues to bear the reputation of being a dystopic 'badland'—plagued by high levels of lawlessness and criminality outside the fortified and surveilled spaces of its private commercial and residential enclaves (Kuldova, 2017). This evident contrast in Gurgaon's socio-spatial landscape tell the sordid narrative associated with the post-liberalisation development thrust of Indian state on the development of large export-oriented industrial zones and infrastructure corridors, specifically in the megacity fringes. This resulted in: (1) The changing role of the state from a key mediatory institution for land acquisition and development to an extractive and regulatory one; (2) the transformation of private real-estate capital from an opportunistic actor in urban development to a predatory one, driven by speculative financial investment; and (3) the violent dispossession and displacement of local land-owning communities from their land, leaving them without fair compensation or long-term, sustainable livelihood opportunities.

Gurgaon's lopsided development trajectory thus appears to be the outcome—an extreme case of what scholars have also referred to as the 'postcolonial urbanisms' in the global South (Roy & Ong, 2011), though one based in the peculiar expansion of the global transnational IT/ITeS sector, which significantly outpaces the sluggish industrial growth in the region. Unique as it may be, Gurgaon is certainly not an isolated case of the IT-oriented urbanisation in India. Indeed, the city serves as an important case example for wider IT-oriented suburban transformation in post-liberalisation India, whose growth trajectory can be both partially and extensively traced in contemporaneous development of other urban metropolitan fringes and satellite towns in India, albeit adjusted for subnational variations in their scope, scale and speed (Chatterji, 2015; Yardley, 2011).

Another somewhat skewed depiction of high-tech clusters or zones in urban India and the wider global South relates to those that depict them as self-contained and autonomous global knowledge enclaves. In different studies, the relative autonomy and independence of these sites is ascribed to processes including: the universal development of the global economy and urban capital (Brenner & Schmid, 2014); the manifestation of global 'cookie-cutter neoliberal urbanism' (Garrett, 2015) and/or the urban boosterist imagination borne out of 'extrastatecraft' (Easterling, 2014), which acknowledges multiple forces within and outside the state with "the considerable power and administrative authority necessary to undertake the building of infrastructure" (Easterling, 2012, p. 2). All the above emphasise the phenomenon of trans-local emulation of new urban development projects that aims to remove the (negative) externalities or interruptions associated with wider, uneven infrastructural provisioning, mundane regulatory and democratic pressures, as well as societal disruptions and unrest that afflict their deemed 'outsides' (see McFarlane, 2011; Odendaal, 2016; Roy, 2009). These narratives suggest that new high-tech agglomerations in suburban India are insulated from bottom-up constraints, local social relationships, and grassroots democracy. Together, such grand narratives of neoliberal urbanisation work to portray high-tech clusters as sites of sovereign exception (Gonzalez-Vicente, 2019) that operate exclusively in service of the networked global economy, but are disarticulated from their immediate environments, including from diverse local economies, forms of labour and micro-political cultures.

Though greatly informative, existing discussions about the development of new, large-scale, IT-oriented urban infrastructure—in the context of India's postcolo-

nial modernisations project and/or its post-liberalisation pathways—provide a partial picture of the phenomena, in so far as they fail to move their focus beyond the initial and violent moment of the establishment of the spaces and the ensuing antagonisms between transnational capitalist elites and local agrarian land-owning classes—the classic conflict between the powerful urban elites and the excluded rural and peri-urban poor (Banerjee-Guha, 2013; Levien, 2013). The overt focus on the narratives of capitalist accumulation by dispossession and expulsion undermines the complex local histories of urban and agrarian transformations and how the different class interests align, fuse together or just fizzle away at different times. As Thomas Cowan (2018, p. 1245) finds in his ethnographic study of urban transformations in Gurgaon, the story of the millennium city is neither "one of wholesale agrarian transition, led by a unitary 'carrier class' of landowning capitalists…nor one of dispossession and the violent expropriation of land by the state and global capital." Both Cowan (2018) and Goldstein (2016) stress that the large-scale urban and industrial developments in India's new urban spaces such as Gurgaon have been mediated by multiple logics of uneven and differentiated agrarian change in postcolonial contexts and the corresponding (unequal) distribution of cultural and political capital between different local caste communities. This uneven process of local development has enriched some powerful actors (e.g., some of the traditional landholding caste communities of Jats and Yadavs, in case of Gurgaon), making them important players in the urban land markets, while forcing others into "petty rentiership and speculative investments in land and property in the city" (Cowan, 2018, p. 1247).

2.2. Beyond Expulsion: Framing the 'Afterlives' of High-Tech Agglomerations in India

Diverging from overt focus of existing literature on spatial and class-conflict produced by large-scale, private sector-led, IT-oriented infrastructural development in suburban India, this article takes a significantly different view of these spaces. While considering the exclusionary nature of the initial sovereign action involved in the establishment of these new spaces of capital, this article goes on to emphasise the need to move beyond, and understand the complex 'afterlives' of these 'globalised' infrastructural spaces—through the reconfigured materialities, changing power relationships and everyday micropolitical cultures that scaffold them. Contrary to their fabled depiction in studies of global urbanisms, neither the state nor (global) capital are overarching, monolithic units "that can be seized 'outside' ordinary social life" (Buire, 2018, p. 2223).

Subsequently, by presenting a close, ethnographic account of IT-oriented urbanisation in India, and its local social and political dis-intermediation, this article attempts to redress the current gaps in urban scholarship. More specifically, following Mezzadra and Neilson (2019), this article frames high-tech clusters and constitutive IT/ITes export zones in India, as containing multiple "divided and layered sovereignties" (Mezzadra & Neilson, 2019, p. 107) and governed by an assortment of normative orders. Thus, even when conceived as 'elite' and 'exclusive' nodes of global digital services production, circulation and trade, high-tech clusters are considered spaces of capital that are thoroughly dependent on their "multiple outsides" (Mezzadra & Neilson, 2019, p. 65), that is, "labour and activity of subjects that cannot be simply reduced to capital" (Mezzadra & Neilson, 2019, p. 70). These include "various forms of hustling, tapping into flows, or distributive labour that spring up, and in many cases, dominate, in situations where capital has done its work of dispossession" (Mezzadra & Neilson, 2019, p. 153). This approach, also further advances Brenner, Madden and Wachsmuth's (2011) earlier criticism of the comparative framework of global (neoliberal) urbanism for its "over-reliance on trans-local learning to explain urban change" (as cited in Datta, 2015, p. 5), since it fails to shed sufficient light on the popular responses to such changes and the exercise of agency by ordinary economic and political actors in the local context (cf. Lund, 2006).

The analysis in this article is gleaned from ethnographic research conducted over 18 months (October 2015–April 2017) by the author in Pune city, an established hub of global IT and IT services exports in India, with a population of about 3.1 million people. The article draws on a combination of three different and overlapping modes of ethnographic data collection, including: (1) participant observations—'deep hanging out' (Geertz, 1998)—with young IT/ITeS workers and job aspirants near Pune's IT parks, office premises, homes, skilling centres and in the suburbs; (2) analysis of media and industry reports evidencing changing demography and patterns of urbanisation vis-à-vis new IT infrastructural developments in the city, as well as reports on popular territorial conflicts and associated local politics; and (3) 105 semi-structured interviews and unstructured interactions over the period of 18 months. The research was conducted with a range of participants, including: (1) IT/ITeS professionals and mid—and high-level managerial staff in Pune's tech parks; (2) low-paid allied service workers (housekeeping staff, IT park security guards) and other informal sector workers (taxi drivers, makeshift restaurant owners) serving the companies, various IT parks and knowledges parks and their workers; (3) NGO workers and government consultants working on issues related to urban service delivery; (4) local civic body representatives; and (5) local academics conducting research on urbanisation in Pune.

3. Pune's IT/ITeS-Led Transformation and Its Suburban Expansion

Pune city is the second largest city in the western state of Maharashtra, after Mumbai, which amalgamates iden-

tities from its past, present and the future: a British colonial barrack town, a Maharashtrian cultural hub, a thriving higher educational destination for young people, a key automotive and engineering centre, and now one of the leading outposts for India's 'global' IT and ITeS outsourcing operations. While each of these identities continue to shape Pune's geography even today, it is the IT/ITeS sector boom that has propelled the city's most recent urban demographic and infrastructural transformation.

Pune first saw the advent of high-tech urban clusters when work began in 1998 on the first large-scale 'special economic zone,' primarily meant for IT/ITeS exports. This was the creation of the Rajiv Gandhi Infotech Park, located in Hinjewadi, adjacent to Pune's western limits (Mahadevia & Parashar, 2008). The developer was the Maharashtra Industrial Development Corporation, a state-led enterprise of the Maharashtra government, which was originally tasked with identifying and establishing key industrial clusters and export promotion zones and corridors, including software technology parks—providing them with requisite physical infrastructures like land, roads, water supply, etc. The Rajiv Gandhi Infotech Park was established in collaboration with the central government body known as the Software Technology Parks of India, which regulates the software technology park scheme that provided various benefits to the registered units in tech parks or knowledge enclaves, including complete foreign equity, different tax incentives, duty-free import, duty-free indigenous procurement, central sales tax reimbursement, domestic tariff area entitlement, and deemed exporting. The Rajiv Gandhi Infotech Park was followed by the establishment of two larger IT park project developments in other parts of the city with greater private sector investments—one in Kharadi and the other in Talawade (Leducq, 2008). These tech parks provided companies with high-speed data communication, technology incubation and innovation centres, network monitoring and data hosting facilities, amongst other modern amenities and infrastructural services. Pune (today) has a high concentration of these large and mid-scale IT/Knowledge parks and enclaves, that co-exist alongside new hybrid commercial and residential townships. While official employment statistics for Pune's IT/ITeS sector are not available from either the National Association for Software and Services Companies or the national body that overlooks the development of new software technology parks of India, a recent industry study quoted in local newspaper reveals that direct employment in the IT/ITeS sector in Pune district to be significant, at about 425,000 people (Jadhav, 2020).

Ever since the advent of the Rajiv Gandhi Infotech Park over two decades ago, Pune city has followed a path of IT-infrastructure-led urban development that is recognisable in other Indian megacities (Chatterji, 2015). Today, it is not just Pune's high-tech IT/ITeS clusters that bear a changed look but, indeed, the areas surrounding them. Where once stood urban villages, informal slum settlements and 'mandis' (small agricultural markets), there are now high-rise luxury apartment blocks, hybrid residential-commercial complexes, smart satellite townships, office towers and posh hotels. That said, unlike Gurgaon, which was designated as a so-called 'greenfield development' and until recently lacked recourse to institutions of local urban governance (see Goldstein, 2016), Pune's suburban fringe areas are already integrated into the city's thriving local municipal domain—making its high-tech urban clusters more likely to be subject to participatory pressures from civic bodies other than Gurgaon's.

Figure 1 shows a map of Pune's land use change pattern from a 2014 study by Nitin Mundhe and Ravindra Jaybhaye. It depicts the growth of the total built-up area in the city over the past several decades. The study asserts that the bulk of this urban growth in the decade 2001–2011 has happened primarily along the city's fringe areas. They attribute this growth mainly to the swift expansion of IT industry and the service sector in the city (Mundhe & Jaybhaye, 2014, p. 55). Indeed, it is in these urban fringe areas that Pune starts to appear like other megacity fringes, not least, Gurgaon's—India's original 'technopolis.'

While Pune's rapid urbanisation trajectory underscores the city's enduring economic growth and its future potential, it also highlights the coterminous expansion of new forms of urban inequalities on the city. This is attested by Pune's informal slum population, whose growth has remained consistently higher than the rate of growth of Pune's total population over the years. According to Mundhe (2019), Pune has about 1.2 million people living in slums; about 40 percent of the city's population, up from 8 percent some 50 years ago. The growing disparities in urban resource distribution have thus also become starker in the last few decades. Today, this disparity stands out visually in the form of the distinct verticality of the glamourous office buildings in the IT parks and the high-rise, middle-class, residential apartment buildings surrounding them, which are contrasted against congested slum settlements of the urban poor, made from simple brick and mortar, sheet metal and cardboard.

4. Archipelago Economies? High-Tech Cluster and Urban Co-Dependencies

If one were to go beyond thinking about modern IT-industry agglomerations in Indian cities as exclusive archipelago economies (Veltz, 2000) of global digital outsourcing, then another visual economy emerges: One that makes these large IT/ITeS clusters and zones visible as intense assemblages of local economic and social activities and logistical labour, whether they be formal/informal, local/global, material/immaterial or legal/illegal. Such a view opens our eyes to the important and enduring relationship between life and operations within and outside these high-tech zones, beyond

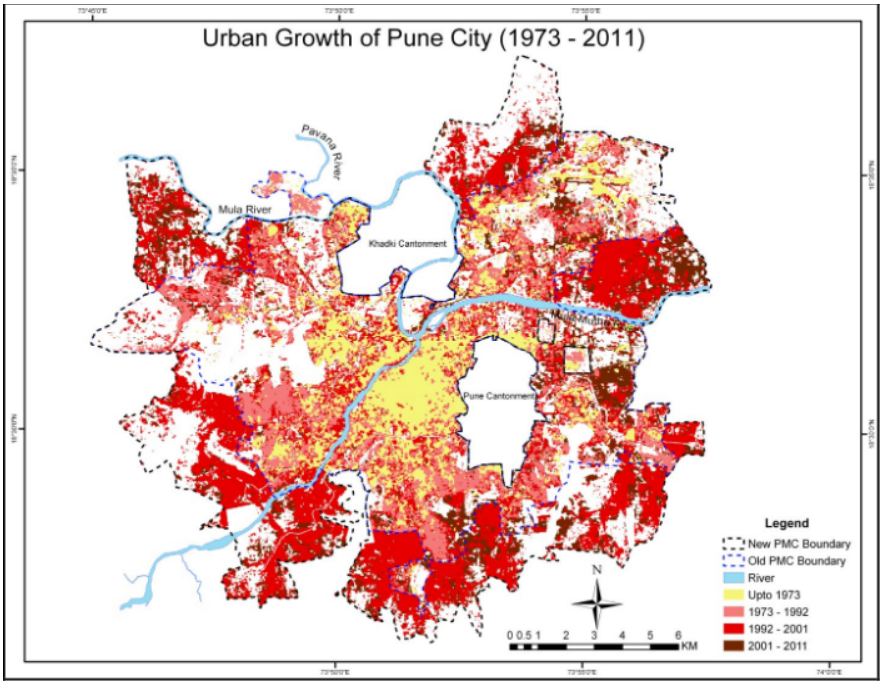

Figure 1. Map of urban growth in Pune city from Mundhe and Jaybhaye (2014).

the original moment of their initial separation. As Sassen (2011, para. 9) elucidates, underlying the growth of "homogenized landscapes and built environments of the glamour zone in global cities" of the global South is the sustenance provided by the primeval economies of 'the global slums'—small businesses, family enterprises, informal services and infrastructures—which gives these spaces certain comparative advantages. Rather than disappearing, these informal urban economies rooted in place respond and adjust to the operations of these new global hubs, demonstrating an inherent plasticity to what are otherwise considered fragile or vulnerable urban economic sectors. This scenario becomes amply visible when one charts the rapid growth of Pune's IT/ITeS economy, which, in less than two decades, has created and produced an uneven urban landscape, while also giving rise to a recombinant informal economy and workforce in the city. Different interview participants attested to this close and co-dependent relationship between the new formal and informal sector expansion in Pune. For instance, Kushal Sharma (name changed), the director of a transnational ITeS firm, and board member of an NGO that worked with the city's municipal corporation on issues of urban planning and governance in Pune, explained:

> Following the IT/ITeS boom in Pune in the 2000s, private sectors realtors started placing bets on land—buying large tracts in anticipation of future economic activity. They focussed largely on Pune's fringe areas—Hinjewadi, Balewadi, Kharadi, etc. The software technology park development scheme of the Software Technology Parks of India, helped by the government, provided concessions and benefits to the registered units in these parks at the time. This was the first phase of transformations of Pune and it was successful in attracting new IT and ITeS sector investment. Several concessions under the software technology park scheme were later discontinued. However, this did not deter real estate investors who had already got the taste of Pune's great potential as a new property market. They continued expanding, placing bets on land, not just in low density areas but also higher density brownfield locations, incorporating established residential and commercial spaces in the city's fringes. These were followed quickly by investments in high-rise residential complexes, shopping malls and other commercial spaces for middle-class professionals who came to work in IT-parks and wanted to settle down near them. Overall, the city [government] gave little incentive to private real estate players to develop public spaces and civic structures like bus stops, roads, streetlights, water supply systems, etc. The outsized expansion of IT-infrastructure development automatically created the spaces for self-organised urban communities, and the informal sector to come in, start operating and serving the needs of the companies and people here, whether legally or otherwise. (Kushal Sharma, April 2016)

Ever since its advent in Pune, private speculation-led, IT-oriented development has become an unlikely source of growth for informal economies and working classes in the city. One can commonly observe the constant movement of objects, services, bodies, practices and ideas between high-tech zones and their outsides, both of which appear to be tied up in complementary and opposing logics of everyday collaboration, exchange and juris-

dictional subversions. Thus, rather than being impenetrable fortresses of global services production and circulation, the different software technology/knowledge park clusters in Pune emerge as mutable spaces that have made possible "various forms of hustling, tapping into flows or distributive labour that spring up, and in many cases, dominate, in situations where capital has done its work of dispossession" (Mezzadra & Neilson, 2019, p. 153).

The intersecting spatialities and temporalities of formal and informal economies become instantly apparent when one visits the biggest tech parks or IT industrial zones in the city's erstwhile fringes of Kharadi, Hinjwadi or Hadapsar. Here, for instance, one sees that the lack of dependable and affordable public and private transport options of last-mile connectivity for the bulk of the workforce in these spaces (including the mass of low-paid 'allied service workers' employed in housekeeping, hospitality and security in these zones) has given rise to a network of undocumented, private vehicles and six-seater rickshaw drivers who ferry workers back and forth from these relatively disconnected locations, operating above regular capacity. The indispensability of these alternative forms of transport is such that, even after the two civic authorities—the Pune Municipal Corporation and the adjoining Pimpri Chinchwad Municipal Corporation—have officially banned them on numerous occasions for public risk after several road mishaps and complaints of traffic congestion and environmental degradation (air pollution), they continue to ply their trade commonly in the city. Indeed, while civil-society activists allege that the number of these vehicles is 12,000–15,000, for every legal auto rickshaw, there are four illegal ones (Puri, 2015). The city's civic and transport authorities, quietly aware of their indispensability, puts their number at much lower. More recently, the proliferation of the 'gig economy' in the city, in digital-app-based ride-share services has taken some of the load off these 'unauthorised' and 'undocumented' modes of public transport; however, they remain important nevertheless because of their overall affordability to the lower-middle-class and working poor.

The two-tiered segmentation of the IT-oriented spaces and labour is further seen in the context of differentiated access to basic services for the different worker classes across most large tech parks in the city. Thus, for example, many workers do not have access to affordable, subsidised food inside corporate messes in these IT parks and come to depend on another more reasonable option—the makeshift roadside food and tea stalls known locally as *Tapri* (see Figure 2). These spring up organically outside the different office campuses and operate round the clock, just like the global operations that take place inside the IT parks. They, then, become spaces where workers gather during their cigarette breaks before, in between or after their daily work shifts. Here, they discuss workplace politics and share their routine lives with others. These adjoining stalls therefore become important spaces where workers can socialise and express themselves more comfort-

Figure 2. Makeshift food and tea stalls (*Tapri*) outside Eon IT Park in Kharadi. Source: Author.

ably and openly, without the same fear of constant techno-bureaucratic surveillance that prevails inside the IT parks.

In the same vein, the renewed influx of migrant populations in Pune looking to take advantage of opportunities in the booming IT/ITeS economy and the other digitally enabled new services sectors often raises the important challenge of affordable housing units for migrants near these hubs of new economic activities. Here, again, the demand for affordable housing is matched by the concomitant growth in 'unauthorised' slum settlements and low-cost neighbourhoods located near these IT/ITeS clusters. These offer different types of rented accommodation and housing arrangements—like shared flats and tenements for individuals, families and groups and paying guest accommodations for young workers, alongside other key amenities, such as food messes and lunch/dinner delivery services; cybercafes; small, private computer skills training centres; and English language learning centres.

Similarly, the lack of public water supply for new, high-rise residential projects in areas adjacent to the large IT parks in the urban fringes is met by another section of Pune's grey or shadow economy. This is known locally as the highly coordinated 'water tanker mafia,' which operates with political and administrative clout and closes the water resource gap for residential, industrial and construction sites in these areas, until these needs can be met legally (a process wrapped in bureaucratic red tape and corruption, which can take several months or years to resolve). Revealing the close nexus that exists between the city's grey economy and the local state, the water is purchased from municipal sources, private wells or bore wells and/or tapped illegally from civic water supply points. According to recent reports, the water tanker mafia in Pune does an annual business of approximately $13.3 million (100 crore rupees; Bhaskar, 2019).

Resonant with Simone's (2004, p. 407) analysis in the context of African cities, the complex formal and informal spatial networks and assemblages around the various tech parks in Pune call into question the physical notions of infrastructure as "reticulated systems of highways, pipes, wires, or cables," in favour of the alternative conceptualisation of 'people as infrastructure.' These are defined as the "flexible, mobile, and provisional intersections of residents that operate without clearly delineated notions of how the city is to be inhabited and used, by engaging complex combinations of objects, spaces, persons, and practices" (Simone, 2004, pp. 407–408). This movement of people enables the constant osmosis of labour, technologies, practices and ideas between these global hubs and their 'ordinary' outsides. Diverging to the tropes of expulsion and dispossession associated with the growth of new infrastructural projects in private satellite cities such as Gurgaon (Kuldova, 2017), what one observes in Pune's urban fringes is the formation of intensive and intersecting network of actors, whose nodes are individuals and communities at the urban margins. Rather than being net losers of the process of new urban infrastructural development in the fringe areas, many of these individuals and communities coalesce around, adapt to and (even) gain from these changes.

5. The Reconfiguration of Spatial Relations and Everyday Micro-Politics in Pune's New Urban Fringes

Recognising the presence of numerous co-dependencies between different IT industrial clusters and varied forms of urban formal and informal infrastructures, it becomes clear that these sites continue to have complex afterlives following the moment of their original and violent conception as some form of sovereign spatial entities. Having said this, it is equally important to keep in mind that the arbitrary and uneven process of land development and urban change, triggered by private investors hedging bets in different areas of the city, is not automatically geared towards creating collaborative urban spaces; rather, these become collaborative over time to meet the needs of diverse local communities and actors, whether they be elite or subaltern. These spaces harbour potential for coalitions, but also contestations and counter-claim-making between multiple actors in the transforming urban context. These new spaces and economies produce broad-based reconfiguration of social and spatial relations and politics in the city, inflected by classed and communitarian positionalities of its actors. This is to say that, contrary to the projected binaries between the 'powerful' capitalist classes and the 'powerless' agrarian classes, or between the neoliberal 'extractive' state and the 'compliant 'subaltern, what emerges is a more diffused urban assemblage consisting of diverse social actors, social infrastructures and services, entwined in differing logics of spatial cooperation and contestation. While territorial conflicts between groups with different class and caste backgrounds is not the central focus of this article, to understand the changing everyday social relations and micropolitics that arise in the wake of large-scale IT infrastructure development projects, it becomes imperative to grasp the heterogeneity of urban actors and their interrelationships in the local context. Broadly, my research confirmed the important role of specific actors and interest groups that co-shape urban realities every day. These include: private real estate or public sector land developers; the elite and newly rich middle-classes; traditional land-owning communities; local political representatives, such as the Municipal Corporators and members of legislative assembly; lower-middle-classes; and urban, slum-dwelling communities, including settled and new migrants to the city.

State authorities like the Maharashtra Industrial Development and large private developers, such as the Pancshil Group, were some of the original investors in Pune's IT-oriented infrastructure developments. Today, new private-sector developers have together built large IT hubs and new business districts in the city's 'new'

urban fringes of Hinjewadi, Kharadi and Hadapsar. The initial developments have also triggered some essential infrastructural investment developments by smaller, private real estate developers in the new urban fringes. Land deals in these new areas are now increasingly negotiated by private developers directly with local land and property owners. Thus, rather than being completely state sponsored, much of the land around these large IT hubs has become a scattered collection of hundreds of large, small and mid-sized private commercial complexes and gated residential enclaves, with some tracts of undeveloped, vacant agricultural lands still visible in their midst. Certain land-owning communities in the city have become enriched from this process of private land development, even becoming real estate investors and developers themselves, using their local community and political clout.

The popular example of Magarpatta city in eastern Pune is often cited as a successful cooperative venture. It is a 450-acre, self-contained, eco-friendly, hybrid township with 30 percent green spaces, large, modern office buildings, residential blocks, hospitals, schools and shopping malls (see Chatterji, 2015; Kantakumar, Kumar, & Schneider, 2016). Here, farmers from the Magar community came together as politically influential agricultural landowners and subsequently became co-owners and developers of their own land, leasing it out to some of the biggest multinational corporations and earning huge profits (Chatterji, 2015; Sami, 2013). However, while Magarpatta city has come to be highlighted as a successful, more participatory and fair model of new urban infrastructural development for the country, this has not been replicated widely, even inside Pune, revealing the different configurations of local political cultures that continue to shape differential outcomes for different urban actors. Moreover, Magarpatta city's success also obscures from view the broader issues of planning that its eventual residents, its users and adjoining neighbourhoods continue to face every day. Thus, for instance, frequent traffic jams on the narrow public roads leading up to Magarpatta city are a significant source of frustration for the local populations, who travel to Magarpatta for work, reside in the area, or simply pass through it every day.

Another set of actors who have assumed great importance in the everyday politics of new spatial developments in suburban Pune, is the city's higher-earners and more affluent 'new middle-classes' (cf. Platz, 2012), that invest in the new residential and commercial projects that sprout around the different IT/ITeS clusters. It is common to see in Pune, numerous billboards with aspirational advertising, promising quick ownership of a high-end modern luxury apartment for upper-middle-class families through loans at low interest rates and easy instalments. Indeed, most IT professionals who I interviewed in Pune, either already owned (at least) one home in a multi-storey 'housing society' in these 'new' areas, rented there, or else aspired to own one in the future. The emergence of this new middle-class oriented urban development projects in Pune's suburbs, further fuelled by the growing penetration of speculative real estate capital in the city, has subsequently given rise to new expressions of middle-class aspirational politics in the city. The usual vehicles of this politics are usually civil society groups and residential associations, which seek to address the numerous gaps in local infrastructure and planning in these 'up-and-coming' areas of the city—whether they be related to the environment, transport, water, lighting, traffic or road development (cf. Menon & Hartz-Karp, 2019). Many of these middle-class civil society groups are well-networked and media savvy, and use their visibility in the public sphere to intervene in and change the course of urban and area development plans, engaging with the state and civic authorities, as well as the private sector developers and companies.

However, Harriss (2005) and Lemanski and Tawa Lama-Rewal (2012) note new middle-class activism in India, in many cases, puts them on a collision course with those who operate the city's informal economy and provide crucial human infrastructural support, namely the lower-middle classes and urban poor communities. In Pune, a similar scenario can be observed. Several middle-class collectives here have regularly protested and advocated for implementing stricter bans on unauthorised, six-seater auto-rickshaws and unauthorised private vehicles on the roads near the different IT clusters, with the aim of reducing congestion and accidents, while also mitigating the rising air pollution in these 'new' areas (see Puri, 2015). In their claims for better roads and traffic management, however, it is the 'illegal' transport economy and its most common users—the informal working classes that often gets the most blame for causing traffic snarls and road accidents in these areas, even when they are the more likely to be at the receiving end of these problems. This, then, has major repercussions for the needs and legitimacy of the informal working classes, who depend on these alternatives modes of transport to access and serve the same affluent spaces and middle-class communities. That said, it is important to remember that the relative power of urban elites and new middle-class groups does not indicate the permanency of (their) territorial antagonisms towards non-elite or subaltern groups in the city, since such a binary can easily hide from view the heterogeneity that exists within the middle-classes in new suburban spaces in India, and obscure the different instances of intra- and cross-class dependence and their alliances on provision of public services and infrastructures (see Lemanski & Tawa Lama-Rewal, 2012). Indeed, one could also argue that while poor road infrastructure and lack of proper transport planning in the new urban fringes of Pune underlines the large neglect by city authorities of these 'new' areas, the resolution of these problems often happens only after new spatial conflicts make these an issue.

The city's informal working classes and urban poor, while cut-off from the more prominent civil society networks, assert their importance by other means. They

rely on their indispensable role as organic lubricators of the city's new IT-oriented infrastructural spaces and their participation in the 'political society'—that is, new forms of urban governmentality which includes grassroots communitarian and civic associations, and the elections of urban, local bodies, such as for the municipal corporation (see Menon & Hartz-Karp, 2019). There is a visible heterogeneity among actors and interest groups within the informal economy and communities as well, which defines how and to what extent they engage in urban spatial politics. For instance, in unauthorised slum settlements adjoining new sites of private IT infrastructure investments in the city's urban fringes, there can be found two categories of migrant populations—recent migrants and settled migrants. While new migrants in these slums looking to access affordable accommodation and sustainable employment in the city do not commonly engage in municipal politics, settled and intergenerational migrant communities see the rise in land prices and private developments around them as an opportunity to collectively demand and push for regularisation and (re)development of their slum settlements from state authorities and municipal representatives in their respective *prabhag*, or municipal ward. Slum regularisation is an important demand of its residents, as it enables these communities to access better civic and infrastructural facilities and entitles them to become recognised property holders, landlords, rentiers and consumers of private services, such as new Internet and mobile communication infrastructures—services that are present in other regularised slums and in the city at large.

The 'municipal corporators,' representing the different wards in the city's new urban fringes with large growth in IT-oriented infrastructure, often come from powerful landowning and farming communities in the city. They can help accelerate, slow down or even block new private infrastructural developments in these areas, often based on their own political interests and/or associated economic motivations. The case of the proposed 17km Kharadi–Shiavane road on the eastern fringes of Pune is an example. The construction of this road has been 'pending' for over 11 years, following issues related to proper compensation to farmer communities who own the land by the state and the municipal corporation. The farmers have been supported in this by the municipal corporator in Kharadi, a local agricultural landowner himself (Kulkarni, 2020a). In a later instance, however, the same corporator supported a group of protesting middle-class IT workers against the inauguration of a vacant land space for a weekly farmers' market by the sitting member of legislative assembly from an opposing political party near their residential apartments (Kulkarni, 2020b). This contrasting posturing by the local municipal representative in different instances provides an insight into the ways in which class- and community-based antagonisms are suspended or superseded in favour of pluralist or pragmatic everyday territorial negotiations, engrained in the local political culture. It is in such ways that everyday micropolitics continues to shape the typologies and the temporalities of local land use, urban planning and development that takes place in and around various IT/ITeS clusters and zones.

6. Conclusion

Recent digital transformations in the economies of countries in the global South have affected not just a physical change in the urban and infrastructural landscapes of cities and their peripheries, but also provoked a profound social reconfiguration within them. As everyday life in the global South is disrupted by these new socio-spatial transformations, there is scope to expand further the digital geographies agenda to include its engagement with uneven urban development and planning in different postcolonial contexts.

This article, rooted in extensive ethnographic research carried out in the city of Pune, has explored the progression of IT-oriented infrastructural developments that have come to define the most recent phase of urbanisation in many metropolitan cities across India. The article contributes in different ways to existing scholarship on urban digital geographies from the standpoint of contemporary southern urbanisms, excavating the complex relationship between contemporary digital transformations in the economy and nature of new suburban expansion in the global South. First, the article has interrogated the conceptual blind spots that exist within contemporary research on global urbanisms that overemphasise the rural–urban divide and related class binaries, in context of large-scale development of IT/ITeS-oriented infrastructures in India's megacity fringes. This article has, instead, emphasised the need to explore the complex 'afterlives' of these new infrastructural spaces in the global South, integrating the different intersecting experiences of heterogeneous economic actors, infrastructures and communities that surround these emergent spaces, and shape their futures.

Additionally, countering popular tropes that identify large IT/ITeS-oriented infrastructural spaces as closed and impenetrable archipelago economies, this article has argued for understanding these sites in the global South, as porous and co-constituted by their ordinary 'outsides.' The article evidences this argument by highlighting how the growth in speculative investments led by the private sector in Pune has also opened new avenues for the expansion of informal economies and infrastructures in the city, which include, amongst other things, provisional and illegal modes of public transport, informal and affordable means of housing, food and water. Over time, these informal and grey economies have become a huge and indispensable part of the city's fabric, revealing important urban co-dependencies that are integral to the sustenance, growth and transformation of these new infrastructural spaces.

Finally, this article has explored the ways in which high-tech development redefines the landscape of urban

micro-politics in India, but also how it gets re-configured (both) by the different territorial contestations and by pragmatic collaborations between different elite and subalterns groups at the local level. Identifying some of the key economic, civic and political actors involved in such spatial negotiations in Pune city, the article shows how the fluid nature of everyday micro-politics surrounding these high-tech global infrastructural spaces may create new forms of urban governmentality and public participation in cities of the global South.

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Conflict of Interests

The author declares no conflict of interests.

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About the Author

Aditya Ray is a Postdoctoral Research Fellow in the Faculty of Social Sciences at the Open University, UK. His ongoing research on the 'working lives in the new India's new services' is situated at the intersection of critical debates in economic, labour and urban geography. This research explores the social, material, developmental implications of fast-paced digitalisation in Indian cities, as well as the role of local agency in shaping new urbanisms.

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