FCJ-212 Issue 29 : Computing The City

Armin Beverungen and Florian Sprenger.

doi: 10.15307/fcj.29

issue doi:10.15307/fcj.29

introduction doi:10.15307/fcj.29.212.2017

Introduction by **Armin Beverungen** of Leuphana University Lüneburg and **Florian Sprenger** of Goethe University Frankfurt.

Ubiquitous computing and the Internet of Things are often referred to as prime examples not only of new modes of computing, but of a new paradigm of mediation itself. If Lewis Mumford could already ascribe key characteristics of media – such as storage and transmission – to the city, so the city could in itself be understood as a medium (see Kittler, 1996), then nonetheless something changes considerably once 'the city itself is turning into a constellation of computers', as Michael Batty noted around twenty years ago (1997: 155). Today the city is indeed awash with distributed and networked computation, and many forms of knowledge and practice not only in architecture and urban planning are turning the city into a subject of computational practices while equipping it with computational capacities. Software codes city space and thereby allows for the co-production of its spatiality; more and more space in the city is reliant on code, producing 'code/space' wherein a space simply does not function without software (Kitchin and Dodge, 2011). This themed issue on 'Computing the City', which emerges from a workshop with the same title held at the Centre for Digital Cultures at Leuphana University Lüneburg in 2014, focuses specifically on the development of urban ubiquitous computing, its status as media infrastructure, its complicity with logistics, as well as its contingent histories and virtual futures. The approach to computing the city taken here questions the accustomed self-description of a mediated society as a completely new infrastructure of living and dwelling. This is not yet another themed issue on the 'smart city' – as we will see below; a consideration of computing the city far exceeds the ways in which the smart city as discourse and project seeks to capture our imaginaries of future technological cities.

The 'smart city' is promoted as the primary site of the materialisation of ubiquitous computing and the Internet of Things: the integration of computational systems with architectural design is supposed to turn inefficient urban settings into smart cities that manifest as the penultimate value-extraction machines (Goodspeed, 2015). In their essay for this issue that focuses on the smart city projects of Songdo in South Korea and Masdar in Abu Dhabi, Orit Halpern and Gökçe Günel demonstrate how the infrastructural imagination of the smart city is tied to neoliberal capital. Marked by speculation, demo-ing and prototyping, the smart city appears as a prime example of how neoliberal capital proposes to deal with crisis and catastrophe. In this context, human life becomes an experiment for technological futures. Computational 'smartness', and the speculation based on simulation and prediction it affords, are presented as ways of dealing with uncertainty which here is reduced to risk, much like in financial markets dealing in futures. The 'absolute hopefulness' that the smart city exudes is built on the creativity and entrepreneurship it demands of its inhabitants, while the machines of logistics and finance – key complements of smartness in the city – keep extracting value. The smart city needs to make no excuses for its failures: it is always only preliminary, failures are part of its experimental character, yet nonetheless it remains infinitely replicable; a model for the coding of urban space around the globe.

Logistics is key here; smart cities are always already logistical cities, not only in the ways in which smart cities like Songdo always require a logistical complement like Incheon (see Halpern and Günel in this issue), but also in the way they rework and extend the model of the 'logistics city' such as Dubai Logistics City (see Cowen, 2014: 163ff.). The connection between ubiquitous computing and logistical cities highlights how smart cities both make possible and are thoroughly conditioned by logistics. Since the invention of the calendar, clock and tower, as explored by John Durham Peters (2013), logistical media not only pervade the city; rather, the infrastructures they make up also connect cities and thereby constitute the logistical and infrastructural networks in and between cities (Rossiter, 2016: 26ff.). In order to understand what Mike Crang and Stephen Graham call the 'embedding of computing into the background environment of cities' (2007: 790),

we need to conceptualise technology or media not as single devices at the end of the line, not as *the* computer or *the* television, but as infrastructures of mediation. Smart cities are oddly part of these logistical networks in that they are not only deeply permeated by logistical media, but even spread their own logics in a protocological fashion as one smart city serves as blueprint for another, further enabling and reproducing logistical networks through infrastructures.

6 Yet it is only in green site developments, such as Songdo, that the logistical city and its digital foundations are built from scratch. Elsewhere, such projects are confronted with the history, sociality, materiality and mediality of existing cities in all their complexity and ambivalence. Making a city 'smart' requires a lot more than subjecting it to protocol or code and digitising its processes. 'Code/spaces are relational, emergent, and peopled', as Kitchin and Dodge argue (2011: 75), so that computing the city is always a complex and contextual endeavour. As Halpern and Günel show, there is much more at play than merely reproducing a model or imposing computation: something that Shannon Mattern (2016) calls the academy-industry-government complex makes the city ready for smartness by rebuilding it. In his exploratory ethnographic engagement of smart cities in India, Sandeep Mertia shows how in the absence of an overarching complex for smart cities, the socio-technical imaginaries of the smart city and big data still produce a perceived shift in the epistemic and material basis of urbanism. Mertia traces this shift in five vignettes: the emergence of a 'new' image of the city with the rise of Google Maps alongside GIS; a new practice of frantic data collection that is lacking in experts; a focus on open data bringing forth new civic data scientists; a playful development of apps in the city to deal with all sorts of social problems; and finally, a transformed political analysis focused on programmatic marketing and sentiment analysis, among other things blurring the line between citizen, user, consumer and voter. As a researcher entangled in these configurations, Mertia calls for a 'meta-analytics' of data that enrols ethnographic work in exploring the material and social aspects of data's work in the smart city.

7 Where the smart city expands, is duplicated and traded in a protocological fashion, logistical infrastructure connects the smart cities in an intelligent web that only knows its own protocological rules and limits. Logistics reveals the logic of smart cities as that of trade and circulation: of data, things and people. In his essay for this issue Ned Rossiter expands on his previous work concerned with logistics (2016) and shifts focus to the kinds of infrastructural media that make possible contemporary smart urbanism. Rossiter sees data centres as part of the infrastructural condition of smart cities, since much of the computational capacity required for (cloud) computing the city resides precisely in these data centres, which follow a geography decoupled from urbanism and focused more on energy and environment. The data centre highlights geopolitical as much as technical considerations. Rossiter finds data centres at the heart of the geopolitics of data-driven, algorithmic capitalism; an approach that produces a sovereign territoriality separated from the state and places notions of geography – such as that of 'Asia' – into question. The infrastructural power produced by data centres Rossiter terms, with Easterling (2014), 'extrastatecraft', and it clearly complements the kinds of infrastructural powers the smart city itself seeks to unfold.

8 What are, in this wider context, the operational logics of the infrastructures thereby instated? Pervaded by visible and invisible networks, the city becomes a playground for global corporations to experiment with technologies of surveillance, big data and endless feedback loops, continuously improving the passageways of commerce. The smartness here is that of technical systems that render urbanites into subjects of cybernetic management, supposedly empowered by their involvement in perfectly organised urban environments, whether it be through models of efficiency or sustainability (see Gabrys, 2016: 185ff.). The intimate relationship between the smart city and logistics implies a certain foreclosure of the city's possibilities and virtual futures. Likewise, the cybernetic visions of computational control mask the limits of computation and the ways in which 'wicked problems' might require political rather than computational solutions (Goodspeed, 2015). Many accounts of smart cities that are dependent on extensive computational infrastructure including data centres, recognise the historical coincidence of cybernetic control and neoliberal capital. Even where it is machines which process the vast amounts of data produced by the city and the ruling and managerial classes disappear behind dashboards (Mattern, 2015), it is usually the logic of capital that steers the flows of data, people and things. Yet what other futures of the city may be possible within the smart city, what collective intelligence

may it bring forth? Can one fathom the possible others of the logistical city in the visions of the cybernetic revolutionaries of Project Cybersyn (see Medina, 2011) or the cyberpunks of the 1980s? What other historical or contemporary examples of resistances to or alternative visions of ubiquitous computing the city could one draw on?

9 Clemens Apprich suggests that it might be worth revisiting some of the 'Babylonian dreams' of the informational cities of the 1990s. In his essay in this issue, Apprich recounts an historical moment where the phantasmagoria of virtual space met the crisis of the city: suddenly the city became a fruitful, usable metaphor for the emerging computational environment, whilst the computer and its network presented an opportunity to save the city by reconstructing it as a political and collective space (for an extended account see Apprich, 2015). Yet, the realisation of this dream in the shape of the network of networks – the Internet – was soon enrolled by neoliberal capital in the service of society and the *polis*, by imposing a market for what a bit later still would be known as 'Web 2.0′ and today we refer to as platform capitalism. In this light, today's smart city behaves according to platform capitalism where individualised smart citizens happily demo for neoliberal life. Apprich urges us to return to the visions and challenges of the informational cities of the 1990s, since their dreams of horizontal networks, collective infrastructure ownership, and common public space, should still be ours today.

10 Dale Leorke recounts a parallel history in a discussion of Ben Russell's *headmap manifesto* (1999). The genre of the manifesto – its form, writing style, and affective message – certainly differs considerably from the white papers and marketing materials produced by the proponents of smart cities today. Leorke recounts the importance and influence of the manifesto for the development of locative media, and how in its wake a collective artistic movement of locative media came forth which produced some of the most exciting experiments with mobile and locative media to date. Yet the story also involves the moment where locative media were corrupted by commercial applications, and overtaken by Web 2.0 and platform capitalism. Leorke recounts that some, such as Andreas Broeckmann, saw this coming in their descriptions of locative media as the 'avant-garde' of societies of control; yet surely few would have been able to foresee the appropriation of locative media for both governance and commerce. Pokemon Go might stand in here as the epitaph to this development; even so, as we will see below, the politics of appropriation are at work in many places.

11 In focusing on the histories of how artistic and experimental developments in computational media have been appropriated for governance, and, by drawing a line from early urban development plans to today's digital infrastructures, it becomes evident that computing the city has to be understood as part of a transition of environments from habitats and spaces of dwelling to objects of planning, management and control. This also becomes apparent in the rise of urban informatics, explored here in the essay by Sarah Barns. The history of locative media as accounted for by Leorke serves as one precursor to the development of urban informatics (see Foth, 2009). Barns recounts how over the last ten years urban informatics has begun to consider the city as an urban laboratory for practical experimentation with forms of computation; recognising the pervasive nature of computing in the city and focusing both on infrastructure as well as softer, social aspects of computation. Where earlier phases of the field were concerned with a kind of 'app-tivism' and on crowdsourcing data and user participation as a method to reclaim the city, more recently the field has moved closer to enrolling computation for governance, for example in a preoccupation with simulation and predictive modelling of various aspects of the city, from traffic to policing. Barns, with Mattern (2016), questions the instrumentalism of urban informatics, and urges us to think beyond what she calls 'platform urbanism' towards a politics of data that is not as closely tied to governance.

12 Smart cities and urban informatics, then, are two approaches which seek to establish a perspective on what computing the city could be. The current talk of 'environmental media' and 'smart architecture' and the change from intelligently-built to intelligent houses or urban spaces resonates with imperatives of sustainability, the politics of control and the territorialisation of private and public space. Since the early electrification of domestic buildings, the presupposition was that spaces become places for the distribution of energy and information. New technical means now add to tendencies where smart homes in smart cities are transforming spaces of surveillance into environments of 'ubiquitous sensing' (Halpern et al., 2013: 291) by massive

sensorial power, and urban citizens are being enrolled as 'citizen sensors' in environmental sensing (Gabrys, 2016: 187). Made up of plugs, switches and alarm bells, of sensors, chips and light barriers, these networks of small, distributed (and in the singular ineffective) agents collect data on movements and actions. In this sense, logistics defines not only the internal flows of the city but also what links these flows together.

13 Focusing on the sensorial, Jussi Parikka explores the elementary basis of distributed urban computing by showing how the two phenomena of smart dust and smog are related to infrastructural developments. Sensing and the sensorial in the city, Parikka shows, cannot be separated when taking into account the ways in which the urban experience of air pollution is part of its production and presumably also of the collection of data. Smog thus appears as a way for making citizens sense. Capture, a mode of surveillance conceptualised by Philip Agre, is a way of collecting data hand-in-hand with the activity about which data is collected (Agre, 1994). Capture thus emerges as an integral part of smart cities and replaces or complements established modes of surveillance via monitoring. Parikka describes air, the most ubiquitous medium in all cities, as an aesthetic phenomenon that lends itself to various uses and abuses.

14 A focus on logistics highlights how the ubiquity of computing in the design of smart cities enables, optimises and speeds up the flows of commerce. While this starting point in a sense presupposes the dominance of neoliberal capital – both in its cognitive dimensions but also in all its material dimensions concerned with global trade – this of course hardly explains how logistics shapes the city. Therefore, it is necessary to explore how urban labour and life are modulated and managed by a politics of parameters – by key performance indicators, self-management and so on (see also Rossiter, 2016: 119ff.). In his essay, Soenke Zehle calls for a politics that questions and challenges the parameters imposed through algorithmic forms of governance in the smart city, and for a politics of ambient 'commoning' that seeks to rebuild and redesign the operational infrastructures of the city. As a mode of surrounding that does not determine the actions of what is surrounded, Zehle shows how the ambient emerges as a chance to explore the environmentality of smart cities.

15 The *polis*, in fact, is what is at stake here: the city not in the sense of a territory, but of the body of its members, ideally self-governed, autonomous and independent, though in historical reality only accessible for a certain class of humans. The ancient Greek *polis*, following Hannah Arendt, can be seen as the origin of western democracy and of western philosophy, and contains within it concepts that have developed into a common practice of the political that integrates public and private (Arendt, 1998). The central space of a *polis* is the *agora*, the market place, where also votes and festivities take place and where a collective identity is framed. The *agora* is the public space in which bodies assemble, which is a precondition of the political in antiquity. The other of the *polis* is, of course, the *oikos*, the house with its domestic economy and ecology, the private space of the family. How is this relation between *polis* and *oikos* transformed, when ubiquitous computing in the city means that power becomes environmental, and urban citizens themselves become sensors that take part in urban governance (Gabrys, 2016)? As citizenship here is remodelled, does it allow for us 'not to be governed quite so much', as Gabrys explores (2016: 190); or does 'self-droning', the transformation of humans into 'networked, sensing devices' (Andrejevic , 2015), result in economic logics usurping any site for politics in the city?

16 What we witness today with the rise of smart cities is a new relation of public and private spaces, in which public spaces become privatised and private spaces are spied out by public institutions and potentially citizens themselves. When we talk about the computerised city, it is still fruitful to return to the idealised Greek concepts of *polis*, of *oikos* and of *agora* – perhaps not only in the sense in which William J. Mitchell spoke of an electronic, disembodied agora in the 1990s, but also through the actions of the Occupy movement and Anonymous. The Occupy movement and Anonymous negotiate the relation of private and public: in 2011, activists all around the world occupied public spaces with their own bodies, which were threatened to become privatised, in order to protest against speculative practices of capitalism and the privatisation of common goods. With their own bodies, and with the help of the technical infrastructures – such as tents – that make up the 'other media' of Occupy (Feigenbaum, 2014), the occupants reclaimed a public that has been lost. Anonymous, on the other hand, stays private in becoming public. By masking

themselves, Anonymous create a collective identity that rises as an imaginary body hiding the private by presenting the public.

17 With regard to these examples, computing the city suggest we explore how digital technologies constitute *polis* and *oikos* in new ways, how they perhaps destroy the traditional assemblage of the city and replace it with a new one, how they bury public and private spaces and open new spaces which we still have to describe. In this vein, Paula Bialski shows how public and private spaces of action overlap when they are performed by improvised co-ordinations between human and non-human actors. Drawing on an ethnography of train ticket sharing, Bialski argues that those 'parasitic infrastructures' that live in and off commercial registers are the result of coordinated attempts to undermine hegemonic uses of infrastructure. Bialski's examples refrain from showing another mode of user participation in which immaterial labour is exploited. Instead, they explore the exploitation of infrastructures by users who employ technological devices in non-hegemonic ways on a daily and non- or semi-professional basis. The 'smartness' of the city is thus counteracted by a more unstable smartness that redevelops its own paths of distribution and attaches to both human and non-human actors. A strategy of action in smart cities could consequently consist in remodelling user smartness and the technologies that enable new forms of collectivity.

18 Bialski shows that the capture of movement can be used for different purposes. With technologies of tracing and tracking we witness a transition from modes of addressing to modes of positioning, in which addressed distribution is replaced by information about the position of the addressees and the imperatives of their movement (Thrift, 2004). The paradigmatic technologies of RFID and GPS not only serve the determination of positions, but control positioning at specific places, because they not only register movements, but start to determine movements. In the last decade this process has revolutionised logistics and the daily use of mobile media, and this has opened a multidimensional politics of environments, which questions our understanding of space and home by deferring the distinction of inside and outside, of private and public. This has led to the necessity of new architectonic concepts and urban plans, followed by a re-purposing of architectural spaces as positioning spaces, in which objects are constantly identified, addressed and related to the position of other objects. All of them act as actors of distribution in encompassing technical environments (Rosol, 2010).

19 In this context, urban studies has become a prevalent field of research for which questions of media, especially the media of representation such as television or graffiti, have become central. Recently, perhaps most prominently in Stephen Graham and Simon Marvin's book *Splintering Urbanism* (2001), questions of digitisation have been foregrounded. These debates reach back to the early and euphoric discourses on the Internet, the communication super highway, and on new forms of connectivity, as they were presented in William J. Mitchell's seminal book *City of Bits* or in Manuel Castells' work. They also react to transformations of computing hardly visible at that time: technologies of tracing and tracking, technologies transforming urban spaces into environments, and technologies of new forms of traffic and mobility. Their infrastructures consist of cables, plugs and switches, of pipes, outlets and windows, of routers, sensors and waves, of media underlying media as infrastructural backgrounds. When architecture becomes environmental – as architectural critic Reyner Banham already intuited in the 1960s – this fundamental change can only be understood by taking into account technological infrastructures: 'When your house contains such a complex of piping, flues, ducts, wires, lights, inlets, outlets, ovens, sinks, refuse disposers, hi-fi re-verberators, antennae, conduits, freezers, heaters – when it contains so many services that the hardware could stand up by itself without any assistance from the house, why have a house to hold it up?' (1965: 109).

20 To put it another way: to understand the computerised city, we have to neglect the computer and find a conceptual language that emerges together with the organisational principles both of computing and architecture of the second half of the 20th century. The threat of fetishising technology can be prevented by conceiving of technology as no longer separate from sociality. The computerised city is a prime example of this tendency: if this urban infrastructure is modified or even if its traditional functionality is called into question, then ineluctable repercussions for the constitution of the social arise. Consequently, social inequalities, differences and struggles are necessarily part of the collected investigations in computing the city. In this sense, the essays in

this issue focus on the infrastructures of distribution rather than on what is distributed. Circulation in the city is thereby understood as a process of interconnected movements of objects, people and data. This process, without doubt, is very relevant to definitions and experiences of meaning and identity (see Boutros and Straw, 2010), but is also part of a remodelling of infrastructural spaces. Distribution on a spatial scale and circulation on a temporal scale both establish different patterns and rhythms that become subject to processes of digitisation.

21 An exploration of the current regime of computing cannot be restricted to the urban or the domestic scale. Both dimensions can only be understood in their relation, as the oppositions of private and public, as inside and outside are constantly negotiated alongside the emergence of new technologies. Following these topics and opening up new perspectives on the interrelation of distribution, digitisation and logistics, the essays in this issue of *The Fibreculture Journal* share a common denominator: the assumption that the smart city is not a phenomenon that will go away but that it is our task to define what smartness in a city means. Calculation and computation, distribution and circulation are shown to be matters of imagination.

Biographical Notes

Armin Beverungen is currently Junior Director at the Digital Cultures Research Lab at Leuphana University Lüneburg. He studied organisation studies and sociology in Lancaster and Cambridge, before completing his PhD on the reception of Marxism in the business school at the University of Leicester in 2010. He has published on the university, financialisation, business ethics, open access publishing, value struggles in the city and digital labour. Armin is involved in a long-term project to engage media and organisation theory, currently focusing on the phenomenon of algorithmic management. He has for many years been involved in open access publishing (with *ephemera: theory & politics in organization)* and is currently a member of the editorial collectives of the open access journal *spheres: Journal for Digital Cultures* and the book series *Digital Cultures* (Meson Press, Lüneburg).

Florian Sprenger is Junior Professor for Media and Cultural Studies at Goethe University Frankfurt. He studied media studies and philosophy at Bochum, Weimar and Vienna. His PhD on *Media of Immediacy – Electricity, Telegraphy, McLuhan* was published in 2012. Before becoming a part of the Digital Cultures Research Lab at Leuphana University Lüneburg he was Visiting Scholar at Stanford University. His research covers topics such as the history of artificial environments, media of immediacy, and the internet of things. He is part of the research project *Data Centres and the Governance of Labour and Territory* at Western Sydney University. He recently published the monograph *Politics of Microdecisions – Edward Snowden, Net Neutrality and the Architectures of the Internet* (Lüneburg: Meson Press, 2015).

Acknowledgements

We would like to acknowledge the support of the *Volkswagen Foundation* for funding the workshop (as part of the *Digital Cultures Research Lab* in *Lüneburg*) out of which this issue emerged. We would also like to sincerely thank our reviewers for their help during the peer review process, and Su Ballard and Mat Wall-Smith for the very enjoyable collaboration.

Notes

This issue of *The Fibreculture Journal* was edited by Armin Beverungen and Florian Sprenger. Managing editor was Susan Ballard. Thanks to all authors for their patience and perseverance.

References

- Agre, Philip E. 'Surveillance and Capture: Two Models of Privacy', *The Information Society: An International Journal* 10.2 (1994): 101-127.
- Arendt, Hannah. *The Human Condition* (Chicago: University of Chicago Press, 1998).
- Apprich, Clemens. *Vernetzt – Zur Entstehung der Netzwerkgesellschaft* (Bielefeld: transcript, 2015).
- Banham, Reyner. 'A Home is Not a House', *Art in America* April (1965): 109-118.
- Batty, Michael. 'The Computable City', *International Planning Studies* 2.2 (1997): 155-173.
- Boutros, Alexandra and Will Straw (eds.). *Circulation and the City: Essays on Urban Culture* (Montreal: McGill-Queen's University Press, 2010).

- Crang, Mike and Stephen Graham. 'Sentient Cities: Ambient Intelligence and the Politics of Urban Space', *Information, Communication and Society* 10.6 (2007): 789-817.
- Cowen, Deborah. *The Deadly Life of Logistics: Mapping Violence in Global Trade* (Minneapolis: University of Minnesota Press, 2014).
- Easterling, Keller. *Extrastatecraft: The Power of Infrastructure Space* (London and New York: Verso, 2014).
- Feigenbaum, Anna. 'Resistant Matters: Tents, Tear Gas and the "Other Media" of Occupy', *Communication and Critical/Cultural Studies* 11.1 (2014): 15-24.
- Foth, Marcus. (ed.) *Handbook of Research on Urban Informatics: The Practice and Promise of the Real-Time City* (Hershey, PA: Information Science Reference, IGI Global, 2009).
- Gabrys, Jennifer. *Program Earth. Environmental Sensing Technology and the Making of a Computational Planet* (Minneapolis: University of Minnesota Press, 2016).
- Goodspeed, Robert. 'Smart cities: moving beyond urban cybernetics to tackle wicked problems', *Cambridge Journal of Regions, Economy and Society* 8.1 (2015): 79-92.
- Graham, Stephen and Simon Marvin. *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition* (London and New York: Routledge, 2001).
- Halpern, Orit, Jesse LeCavalier, Nerea Calvillo and Wolfgang Pietsch. 'Test-Bed Urbanism', *Public Culture* 25.2 (2013): 273-306.
- Kitchin, Rob and Martin Dodge. *Code/Space: Software and Everyday Life* (Cambridge, MA: MIT Press, 2011).
- Kittler, Friedrich A. 'The City is a Medium', *New Literary History* 27.4 (1996): 717-729.
- Mattern, Shannon. 'Mission Control: A History of the Urban Dashboard', *Places Journal*, March (2015), https://placesjournal.org/article/mission-control-a-history-of-the-urban-dashboard/
- Mattern, Shannon. 'Instrumental City: The View from Hudson Yards, circa 2019', *Places Journal*, April (2016), https://placesjournal.org/article/instrumental-city-new-york-hudson-yards/
- Medina, Eden. *Cybernetic Revolutionaries: Technology and Politics in Allende's Chile* (Cambridge, MA: MIT Press, 2011).
- Mitchell, William. *City of Bits: Place, Space and the Info-Bahn* (Cambridge, MA: MIT Press, 1996).
- Peters, John Durham. 'Calendar, Clock, Tower', in Jeremy Stolow (ed.) *Deus in Machina: Religion, Technology, and the Things in Between* (New York, NY: Fordham University Press, 2013), 25-42.
- Rosol, Christoph. 'From Radar to Reader: On the Origin of RFID', *Aether. The Journal of Media Geography* V. A. (2010): 37-49.
- Rossiter, Ned. *Software, Infrastructure, Labor: A Media Theory of Logistical Nightmares* (New York, NY: Routledge, 2016).
- Thrift, Nigel. 'Remembering the Technological Unconscious by Foregrounding Knowledges of Position', *Environment and Planning D: Society and Space* 22.1 (2004): 175-190.
- Weiser, Mark. 'The Computer for the 21st Century', *Scientific American* 265.3 (1991): 94-104.

The Fibreculture Journal (ISSN 1449-1443) — Issue 29, 2017-06-29. This article is published under CC BY-NC-ND. The author retains copyright.
This PDF is an archival offprint generated from the journal's text archive. It is not the publisher's version of record; the published article is at https://twentynine.fibreculturejournal.org/issue-29-fcj-212-computing-the-city/. Page numbers here are not the published pagination. Where paragraph numbers appear in the margin they are the journal's own and are the citable unit.