

tures of the future” (Knox 2017, 363). Such observations of performativity do not only affirm the relevance and timeliness of *The Experimental City*, but also the importance of substantial STS engagement with the issues it puts forward and the types of cities it enacts.

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Jennifer Gabrys

Program Earth. Environmental Sensing Technology and the Making of a Computational Planet, Minneapolis, University of Minnesota Press, 2016, pp. 368

Caspar Menkman *Maynooth University*

Program Earth is about the becoming environmental of computation. In this book Jennifer Gabrys attends to the (per)formative role that calculative and sensing technologies play as part of everyday and extraordinary environments. These spatializing properties have previously been remarked on in other academic disciplines. For instance authors in computer science (Weiser 1993), social science (Kitchin and Dodge 2011),

and media studies (Hayles 2009) have emphasised the complexities that arise as coded technologies and spatial operations become mutually dependent.

What makes Gabrys' contribution to this discourse distinctive is her propositional approach. She presents the reader with an engaged narrative on the role of sensors, computation, and associated technologies as part of everyday environments. Throughout the book she introduces encounters that range across different environments and involve different actors with wholly different intentions. In some of these, technologies are made explicitly visible, while others show them as part of the background, quietly going about their work. However, what all they have in common is the formative role of sensor technologies. In *Program Earth* Gabrys asks the reader to reflect on what this means. And, to accomplish this effectively, she develops a set of theoretical and philosophical assertions that carefully position the public alongside environments and technologies. Such an appreciation, she argues, can change how we are part of environments, how environments function, and how otherwise distinctive spaces are able to relate to each other.

The book could possibly have been called “Programmable Earth”. Whereas a program refers to a structure that is followed, Gabrys intends to describe something else. She sets up computation, code, and data as part of encounters between environments, devices, and other entities to show how they become together. This approach is distinct from utilitarian narratives that promise technology's immediacy, neutrality, or efficiency; and equally from those critiques that point towards programmatic or disciplinary capacities. For Gabrys, sensors enable an “expanded engagement with programmability” that helps to consider “how code is not a discursive structure or rule that acts on things, but rather is an embodied and embedded set of operations that are articulated across devices, environments, practices, and imaginations” (p. 41). This distributed approach to action and encoding, links her work to theorists of more-than-human relations (Haraway 2016), co-production of politics and space (Jasanoff 2004), or other literatures that are hesitant to accept *ex ante* normative categories or deterministic relations. That is not to say that power and the potentials associated with technology are forgotten. A recurring theme is the distributed spatial effects including the issues that arise with access, constraints in use, and skills. However, her focus remains with interdependencies and the productive qualities that emerge from these operations.

Program Earth consists of three sections: “Wild Sensing”, “Pollution Sensing”, and “Urban Sensing” and each is made up of three chapters. The sections represent distinctive epistemic projects wherein sensors together with humans and non-humans constitute directed technographic milieus. In the individual chapters Gabrys settles on a handful of empirical examples that follow comparable logics to illustrate a partic-

ular, often theoretical, contribution. While the chapters can be read individually, as they are relatively self-contained, all of them rely heavily on the introductory chapter. Throughout these first thirty pages the reader is familiarized with the author's spatial thinking that comes from constructivist roots, with Whitehead, Simondon, and Stengers being the primary interlocutors. Here she also introduces her key spatial metaphors: environment, milieu, and ecology.

The section on "Wild Sensing" describes remotely monitored environments that primarily serve human learning and understanding. This topic is explored to illustrate how sensors act on existent environmental relations. While the adjective "wild" in the section's title suggests these spaces are typically not considered subject to human intervention, the assumed distance between observed environment, the technologies that monitor, and other entities enrolled in the process of observation is questioned. Gabrys does this by stating that within these environments sensors operate "not as instruments sensing something 'out there' but rather as devices for making present and interpretable distinct types of ecological processes" (p. 29). Sensors and networks do not just extend the reach of people, but equally make environments show up as active. This fits with recent work in STS that turns to ontology (e.g., Law and Lien 2013) to focus on the contingency of events, objects, and entities. In doing so, Gabrys shows the generative potential of sensors to produce and couple previous unconnected environments with contextual knock-on effects.

A demonstrative example is Spillcam, a stationary webcam installed to livestream the 2010 BP Deepwater Horizon oil-spill. Gabrys shows how a single camera allowed for the distribution of interest to this environmental disaster by enabling the formation of new spaces, practices, and identities in response to it. It visualised the ongoing crisis, the scale of which would otherwise remained largely inapproachable and hidden to the general public. While turning to such a vision of an event evidently also leaves things out, the overarching thesis of the chapter is that sensor-based monitoring can draw those not immediately present into a relation to particular events.

In the chapters themed "Pollution Sensing" Gabrys explores the status and potential uses of sensors as having an impact on the coding of environments. By doing this, she strikes a more political tone as strategic and speculative applications of data to environments are considered. These, she argues, can contest otherwise taken for granted environmental relations. So where the first section explored how environmental relations work, here she qualifies what uses they afford to those affected by them. This involves the tapping into alternative repertoires of knowledge and possibly the remaking of environmental relations.

For example environmental citizenship is introduced as a category that runs counter to modern state-bound definitions of belonging. As the becoming part of a milieu, it proposes more open-ended ideas around

who or what should have a stake in the politics of environments. Gabrys inverts the “politics of environment” to “environmental politics” and extends membership to all entities with a stake in it. An environment's politics, she speculates, can be produced from within instead of being imposed from without. This is illustrated through sensor technologies that can act as speculative tools enabling positive engagements with complex issues like climate change, that for once do not have to pass through the state. Moreover, the assertion that sensors and the data they generate are relevant to how environments are performed comes with the consideration that this requires new forms of sensor-based participation. This revelation results into questions like: “What experimental forms of politics and environmental practices might we develop that are able to attend to these indeterminate and emergent matters of concern?” (p. 155).

Finally, in “Urban Sensing”, Gabrys explores the potential of sensors and their networks to curate and control environments. She introduces environmentality as an inherently spatial form of governmentality, to show how sensors can pose a variety of challenges to environments and their constituencies. The smart city is the paradigmatic example of an environment where sensors are part of “universal visions” of lived environments that are “always the same in their striving for optimization” (p. 261). However, as a common thread the author argues for contingency and difference. Writing that there exist important frictions between regimes that privilege processual expediency on one hand and those that value privacy and comfort on the other. Not breaking character, Gabrys develops a set of strategies and tactics to deal with this as “to be simply in opposition is to be already defeated” (p. 291).

One tactic for critical reflection is through the conceptual persona of the idiot. This ideal person does not follow conventions, but instead questions constitutive characteristics that would otherwise be commonsensical. This inquisitive approach to sensor technologies allows a framing that is part of larger infrastructural narratives, where people can move beyond “simple choices” of subjectification between buy-in or opt-out, to more open conversations about alternative modes of engagement that make possible substantive participation in issues involving sensors.

To conclude, Jennifer Gabrys' book is a timely publication that combines empirical insights with a necessary speculative attitude in an emerging field. It complements earlier publications that critique or applaud the utility of sensors by embodying the “could be different” attitude so at home in STS. It works well as a companion with the work from Gabrys' own *Citizen Sense* project as it shows why these trajectories around emancipation, education, and action based narratives are important. Other productive directions are discussions on the democratic potentials of technologies such as those stemming from STS sub-disciplines like the public understanding of science and technology (Irwin and Wynne 2003). The abundance of possible connections the work make attest to its fit as

part of the current discourse on science and technology. Whereas by itself it offers a provocative and engaging read. To me its the propositional approach Gabrys follows, in combination with the rich empirical accounts on societally pressing issues, that makes it helpful in challenging the otherwise settled rules and roles of science and technology.

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Smart City. Strategie, Governance und Projekte [Smart City. Strategy, Governance and Projects], Wiesbaden, Springer Vieweg, 2016, pp. 346

Susann Wagenknecht Siegen University

Smart cities, talk of the town. But are we about to construct a new urban architecture indeed – an architecture that will serve the needs of our cities better, in more efficient, more sustainable and more participatory