

TECHNO-SOCIAL ENTANGLEMENTS AND CONTESTED URBAN FUTURES:  
PRODUCING SPACE, SUBJECTIVITIES, AND ECONOMIES IN THE DIGITAL CITY

by

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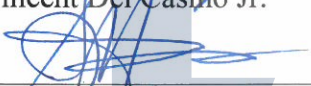


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## ABSTRACT

With the rapid development of new digital technologies, cities are increasingly critical sites of techno-social experimentation and transformation. Through ‘smart city’ initiatives, city governments around the world are partnering with transnational technology firms to deeply integrate digital technologies—including extensive Internet of Things (IoT) sensing networks and increasingly complex infrastructures for data analytics—into everyday urban spaces. At the same time, emerging forms of digitally-mediated “platform capitalism,” represented by companies such as Airbnb and Uber, are dramatically disrupting existing economic, political and socio-spatial relations across urban contexts. In opposition to these trends, citizens’ initiatives in Barcelona, Spain are organizing around calls for “technological sovereignty,” radically rethinking existing models of urban development by claiming community control over emerging digital technologies.

My ethnographic dissertation asks: Are emerging digital technologies inherently tools of technocratic governance, surveillance, and capital accumulation? Or how might they become loci for imagining and building alternative digital urban futures? I operationalize this question through three sub-questions focused on the production of alternative economies, urban space, and digital subjectivities, respectively, within the movement for technological sovereignty in Barcelona. These three sub-questions are the basis of the three articles attached as appendices.

The first paper (Appendix A) explores the concept of technological sovereignty employed by activists in Barcelona, describing its basis in experiments with alternative arrangements of work and property, an ethics of care, and an engagement with municipal institutions. Reviewing existing literature on the politics of digital development in geography, I argue for the need to think beyond critiques of techno-capitalist development—and beyond binaries of techno-optimism and techno-pessimism. Analyses of ongoing processes of technological change in general, and smart cities in



particular, too often present emerging digital technologies as silver-bullet solutions to a multitude of existing societal problems—making the world more connected, efficient, and sustainable, holding the promise to improve quality of life for millions of people. In contrast, more critical approaches highlight the ways such processes facilitate increased state and corporate surveillance, new forms of power and control, and new forms of exploitation and exclusion. Beyond such binaries, this paper argues for the need to imagine a multiplicity of possible social futures emergent in the entangled processes of urban and technological change. It explores the practices and discourses of the TS movement as a way to demonstrate how such alternatives might be brought about through grassroots organizing and collective experimentation.

The second article (Appendix B) engages geographic literature on the automatic production of space—the way evolving assemblages of hardware, code, and data produce space with little to no direct human intervention—viewing it through the lens of philosopher Bernard Stiegler’s notion of proletarianization as the loss of knowledge. In contrast to this view of digital infrastructure, I describe the practices of Guifinet—neighborhood-based associations that build and maintain their own broadband internet infrastructure—focusing on the multiple forms of knowledge production and circulation on which the project is based. I present Guifinet as an example of amateur practices of *de*-proletarianization—as participants re-claim critical forms of knowledge about the processes (re)producing urban space. In doing so, I demonstrate the possibilities for digital infrastructures to create new spaces for democratic power based on alternative logics of techno-social organization.

The third article (Appendix C) explores the question of digital subjectivity in the movement for technological sovereignty in Barcelona. I approach digital subjectivity as the way people understand their relationship to digital technology and processes of technological change, structured by discursively produced hierarchies of technological expertise that are intimately

entangled in the reproduction of gender, race, class, age, and other axes of difference. The paper employs the work of Stiegler (1998) and Barad (2007) to explore the co-constitution of humanity and technics, and recognize the way material practices involving an array of human and nonhuman actors iteratively reproduce hierarchies of difference. Against the hegemonic subject positions of techno-capitalism, I explore the practices of technological sovereignty activists that challenge the discursive privileging and separation of “technical” knowledge from its social entanglements and produce a diversity of subjects enacting a being-toward alternative techno-social futures.

## INTRODUCTION

“[I]f too many ruins are being accumulated in the name of ‘development’ and economic competition, then this raises a preliminary question: what relation to technics and technologies would enable us to think the reconstruction of a global future?” (Stielger 2013, p. 10)

“How should we reimagine contemporary cognitive ecologies so that they become life-enhancing rather than aimed toward dysfunctionality and death for humans and nonhumans alike?” (Hayles 2017, p. 141)

At the 2016 meeting of the World Economic Forum in Davos, Switzerland, the forum’s founder, Klaus Schwab, coined the term the “4<sup>th</sup> Industrial Revolution” to refer to the ongoing development of new digital technologies that are increasingly proliferating into the spaces of everyday life. These technologies include developments in “artificial intelligence, robotics, the Internet of Things, autonomous vehicles, 3-D printing, nanotechnology, biotechnology, materials science, energy storage, and quantum computing” (Schwab 2016). According to this discourse, these technological innovations promise (or threaten) to “disrupt” existing forms of social, cultural, political, and economic organization—including widespread changes to work and employment (Stiegler 2015; Bissell and Del Casino 2017), health (Lupton 2013), transportation (Narla 2013), and liberal democracy (Zúñiga et al 2010; Lynch 2017).

Within this vision, the “smart city” is pictured as the ideal spatial form of the technological future-in-the-making—urban spaces structured by dense infrastructures of sensors, servers, and autonomous and semi-autonomous devices that direct flows of people, information, and resources (Albino et al 2015). These advances produce unprecedented amounts of data, allowing the once unruly spaces of the city to be known and controlled in previously unimaginable ways (Kitchin 2014; Leszczynski 2016). New “urban operating systems” and centralized control rooms integrate

data across systems allowing for the common coordination of energy, waste, transportation, and security systems, for example, across a given city (Mattern 2015; Marvin and Luque-Ayala 2017). Such new forms of control lay the ground work for the future proliferation of autonomous and semi-autonomous machines—from robots to self-driving cars—in urban space, as these machines can be networked to the broader data streams and thus navigate complex urban environments (Sanfeliu and Andrade-Cetto 2006). Proponents of this vision argue that these developments will make cities more efficient and sustainable while increasing transparency in governance and overall health, security, and wellbeing for urban residents.

Schwab’s notion of the 4<sup>th</sup> Industrial Revolution (hereafter “4IR”) and related visions of the smart city, which have now been widely adopted by policymakers, entrepreneurs, and others<sup>1</sup>, present a narrow vision of the future. This future is driven forward by continually accelerating technological change to which individuals and communities are called upon to adapt. Those who fail to adapt to the demands of the information economy will be left behind. As Garcés (2018) argues, this discourse represents a kind of perversion of post-human thought—in which processes of technological change are afforded an agency over and above any “human” ability to interact with it. By presenting technological innovation as the primary driver of change, promoters of the discourse of the 4<sup>th</sup> Industrial Revolution aim to de-politicize complex social, political, economic, and cultural issues. A techno-capitalist future becomes seen as the only possible one.

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<sup>1</sup> References to the Fourth Industrial Revolution litter the University of Arizona’s 2018 Strategic Plan. In the introduction, President Robert Robbins writes: “Its framework is inspired by the Fourth Industrial Revolution — a time of augmented intelligence and the fusion of digital, physical, and biological worlds. Navigating tomorrow’s ever-evolving societal, economic, and cultural landscapes will take audacious ingenuity” (University of Arizona 2018, p. 2). The language of “navigating” the future, rather than shaping or contesting the future it is common in this discourse.

This dissertation contests the narrow imaginary of the future presented by the Fourth Industrial Revolution (4IR) and its claim to inevitability, and calls for a radical re-thinking of human relationships to technology and the possibilities for alternative urban futures. In the face of the purported inevitability of the 4IR, observers of technological change have tended to fall into one of two categories. While techno-optimists celebrate the potential of technological advancements to solve intractable problems of sustainability and increase overall well-being, critics explore the potential of ongoing processes of digital development to create new forms of surveillance and control (Klauser et al 2014; Leszczynski 2016), and increased inequality (March and Ribera-Fumaz 2016)—accelerating processes of capital accumulation. While much of this critical literature recognizes the entanglement of evolving technological systems in a broader socio-technical milieu, there have been fewer attempts to explore how this socio-technical milieu might be re-organized, re-directed, or inflected to produce different, more progressive and just outcomes.

Both the techno-optimism of smart city and 4IR proponents as well as the critical discourses of their detractors risk relying—to different degrees—on a lingering techno-determinism that fails to recognize or fully explore the complex entanglements of technological objects and systems in broader social, political, and economic processes. In the digital geographies literature, Rose (2017) highlights the failure of most scholars to fully theorize *posthuman* agency, presenting it as a mere resistance against the emerging and evolving agency of digital systems. This failure of existing literature helps explain the persistence of the techno-optimist/techno-pessimist binary. If technical devices and systems possess an agency against which humans can only hope to “resist”, then the possible outcomes of processes of technological development and expansion are limited—and thus easily declared positive or negative.

Rose calls instead for an approach that recognizes the way human agency is exercised through practices of reinvention with digital systems. Such a theoretical approach opens possibilities for imagining and building alternative sets of practices and meanings in relation to digital technologies. This opening to alternative practices and relationships is seen as well in the two quotations in the epitaph. Stiegler and Hayles both call for a re-imagining of the futures made possible by advances in digital technologies. They both highlight the ways technological development has become tied to regimes of capital accumulation, social inequality, surveillance, and ecological destruction. Yet, they do not see this to be the inevitable outcome of technological advancements and digitalization.

Historically, access to emerging technologies and their integration in everyday processes of production and consumption have long been the focus of politics, from workers' struggles over control of the means of production, to geopolitical conflict and colonial projects focused on establishing national technological superiority. Progressive and utopian thinkers have long imagined the possibilities for democratizing access to technologies and technological knowledge—portraying such possibilities through science fiction and political treatises. Such utopian imaginings have continued in the present. Srnicek and Williams (2015) and Mason (2016), for example, have recently put forth proposals for harnessing the power and productivity of advancements in digital technology to implement a “world without work.” These writers call for new forms of public policy, in which the state heavily taxes or otherwise collectivizes advancements in digital technology in order to ensure a universal basic income that meets the essential needs of all citizens.

While I am sympathetic to these authors' goals, I am concerned about such proposals' simplistic understanding of power, and reliance on the State and a rights-based notion of

citizenship—which supposes new forms of centralized control and administrative processes of inclusion and exclusion. Further, this framework fails to re-think human relationships to emerging technologies—how we use them, adapt them, think about them and think with them—and thus risks reinforcing existing practices and inequalities. This dissertation is interested in grassroots alternatives. Building on Rose’s (2017) theoretical intervention asserting the role of *posthuman* agency and the co-constitution of humanity and technics, this dissertation offers an empirical and theoretical exploration of the possibilities for radical forms of “reinvention” in which individuals-in-collectives remake their social world, their spaces, and themselves through experimentation with open-source digital technologies.

### **Research Context and Questions**

I came to be interested in the topic of digital technology and competing visions of urban futures several years ago, while researching a master-planned “new city” and autonomous libertarian enclave project in southern Honduras. The project was supported ideologically and logistically by leaders from Silicon Valley, who hoped to experiment with new forms of free-market governance and territorial organization—pushing far beyond existing ‘neoliberal’ experiments (Lynch 2017). The city was imagined as the future site of offshore data centers and technology manufacturing, and—like all new city projects around the world—projected as a smart city that would make use of all the latest technologies for urban governance and management (Datta 2018a; Lynch 2018). Technology was not the primary focus of the project; rather, notions of digital innovation and development appeared to be seamlessly integrated into its driving libertarian capitalist political economic ideology. While I had long been interested in the political and cultural power exercised by “tech visionaries” and utopian thinkers with ties to Silicon Valley,

this research raised an important new question for me: why do these thinkers seem to possess a kind of monopoly over how we understand and imagine technology and its role in social and political life? It was this question that inspired me to take up this project.

Based on these experiences, I became particularly interested in the notion of the “smart city” and the way this vision of the future city seemed to become the new normal for urban development and re-development projects globally. I found ample scholarly work examining the smart city discourse and critiquing its political economic model—based on the privatization and de-politicization of urban governance (e.g., Kitchin 2014; Wiig 2015)—and its logics of control and surveillance for disciplining the unruliness of urban life (e.g, Klauser et al 2014; Vanolo 2014; Leszczynski 2016). Yet, I found little in the academic literature about what it would actually mean to live in a smart city, or about how its narrow discourse of technological development and efficiency might be challenged politically in practice. Upon researching where in the world this smart city agenda had taken hold, I was surprised to see Barcelona topping several lists of global smart cities. This smart city model seemed an awkward fit with the city’s reputation as a hub of resistance against corporate globalization (Juris 2007) and austerity (Antentas 2012), and of robust local democracy (Blakeley 2005) and economic cooperativism (Miro and Fernandez 2016). It was this tension that drew me to Barcelona as a potential site to study the politics of digital development in urban life.

In 2011, then-Mayor of Barcelona, Xavier Trias, launched an initiative to turn the city into a premier smart city. Under his leadership, the municipal government entered into new partnerships with technology firms like Cisco, IBM, and Telefónica to become a test-bed of smart city technology. The city launched a series of pilot projects across transportation, education, health, energy, and other sectors, and developed CityOS, an operating system allowing for the integration



of data across urban systems. Figure 2, taken from the BCN Smart City website, reads: “A city that wants to aspire to really be *smart* has to develop all its key areas (transport, education, health, waste management, security, economy...) simultaneously and transversally” (BCNSmartCity website, accessed 16 September 2016). The graphic demonstrates the way integration of urban data across sectors was seen as the key to making the Barcelona a sustainable and “self-sufficient city” (Guallart 2012).



*Figure 1: BCN Smart City Website in September 2016. Translated from Catalan: "A sustainable and self-sufficient city nourished by innovation and new technologies: A city that wants to aspire to really be smart has to develop all its key areas (transport, education, health, waste management, security, economy...) simultaneously and transversally." (BCNSmartCity Website, Accessed 16 September 2016)*

In their critique of the Barcelona Smart City program, March and Ribera-Fumaz (2016) highlight how the municipality’s approach under the Trias administration worked to de-politicize urban governance and legitimize processes of re-development that rose land rents and intensified processes of displacement and exclusion in traditionally working-class neighborhoods. In their conclusion, the authors call for a politicization of the smart city, writing: “it is necessary to start to

imagine and construct alternative urban utopias. These new imaginaries should go beyond the actually existing Smart City” (March and Ribera-Fumaz 2016, p. 827). It is common to find such calls to imagine progressive or radical alternatives to hegemonic visions of urban futures in the conclusions of many academic articles and popular writing about the smart city and emerging digital technologies (Greenfield 2017; Kitchin 2014). Yet, despite these calls, there have been far fewer empirical and theoretical explorations of such possibilities.

Over the past several years, a grassroots community movement in Barcelona has begun to imagine and build alternative visions of the city’s future loosely organized around the notion of “technological sovereignty” (hereafter, “TS”). The discourse of TS calls for implementing new forms of community control over digital technology. I arrived in Barcelona to study the politics of smart city development in June 2016, just a few months after the first annual Congress on Technological Sovereignty (or SobTec), organized around the theme of “Re-Thinking the Model of the City.” SobTec brought together representatives from across the city’s hacker and activist communities, and featured talks on the intersection of digital technology and urban development, gendered violence, surveillance, infrastructure, and ethics (Figure 2). A dossier titled *Sobirania Tecnològica* published by activists at the Calafou Post-Capitalist Eco-Industrial District outside Barcelona in 2014 examined alternative, open-source, and community-based technological projects from around the world and had helped establish TS as a discourse prior to the first SobTec.

**I Congrés de Sobirania Tecnològica** Del 19 al 20 de febrer de 2016

Responsabilitat: **el trencador de circuit**  
www.trencadorde.circuit.cat  
www.congresstecnologica.cat

● TALLERS  
● TALLERS DE RESISTÈNCIA  
● TALLERS DE DIFUSIÓ

**DIVENDRES 19** SALA D'ACTES

18:00h **L'urbanicidi com a espectacle. Barcelona i la política de grans esdeveniments.**  
Miquel Dopazo | Miquel Dopazo, Miquel Dopazo | Anna Llorens i Copolovici | Anna Llorens i Copolovici | L'alt Coroneria Lluís Martí | L'alt Coroneria Lluís Martí | Isabel Martínez Gili | Isabel Martínez Gili | Javier Marín Cortés | Javier Marín Cortés

**DISSABTE 20** SALA D'ACTES

10:00h **Sobirania en infraestructures. Xarxa Telecomunicacions de Comuns**  
Rafael Magalhães

11:00h **Estratègies de resistència vs Màquines de vigilància.**  
Sobirania

12:00h **Municipi i tecnologia: on som i futurs possibles.**  
Dimitri Lamberti | Dimitri Lamberti

15:00h **Software lliure a Veneçuela: Una batalla per la sobirania tecnològica.**  
Rafael Díaz

14:00h **D I N E R**

15:30h **T A L L E R S**

AULA 208	AULA 209	AULA 214	SALA D'ACTES	AULA 11 LU DOT ECA
La Governança d'Internet: Introducció i... Jordi Sureda   Jordi Sureda	Seguretat a la xarxa. Xavi	La Xarxa a l'Abast: 18 anys d'evolució, eines públiques i privades. Anna Milla	Smart Cities: de la teoria a la pràctica. Eduard Cerdas   Eduard Cerdas	"Primer pas a l'ètica de la tecnologia: TSB per a totes"
Cryptoparades: protecció individual. Jordi Sureda   Jordi Sureda	Taller de reparació i actualització per a dones. Margarita Peña   Margarita Peña	Xarxes socials, dades i l'ètica: de la teoria a la pràctica. Jordi Sureda	Compartició de codis. Pedro Guillot	ESPAI DE NETWORKING: Presentació projecte d'Internet TSB
<b>Violència Masclista i noves tecnologies.</b> Marta Collado   Marta Collado   Inés Martínez   Inés Martínez   Clara	Anna Mena   Anna Mena			AULA 11 LU DOT ECA: Sessió d'informació i programació per a petits i grans amb Scratch.
19:00h <b>Software lliure en l'ètica i la pràctica.</b> Richard Williams				

Figure 2: Program for 1st Congress on Technological Sovereignty. Themes including: “Urbanicide as Spectacle: Barcelona and the politics of large events”; “Sovereignties in infrastructures: Commons-based Telecommunication Networks”; “Resistance strategies vs. Surveillance machines”; “Municipality and technology: Where we are and possible futures”; “Free Software in Venezuela: A Battle for Technological Sovereignty”; “Masculinist Violence and New Technologies”; “Free Software in ethic and practice”

In the years since, a diversity of loosely-networked activists, collectives, and cooperatives across the city have taken up the TS discourse—employing it and reworking as they experiment with open source technologies in community-based projects. Table 1 outlines the diversity of projects associated in some way with the notion of technological sovereignty. Initiatives like Guifinet, CommonsCloud, or the Ateneus de Fabricació work to build, maintain, or manage digital infrastructures or hardware—from broadband internet infrastructure to cloud storage and 3D printing. Programming cooperatives offer services on the local market based on free software and ethical business models, while eReuse and Alencop work to promote the responsible recycling and re-use of digital devices. Others are experimenting with open-source applications and digital platforms to manage and organize cooperative economies in the food, mobilities, or service

sectors. Finally, a variety of initiatives organize community education and training, or create spaces for collective reflection and theorization taking a critical perspective on ongoing processes of technological change. These projects and the overarching discourse of technological sovereignty have worked to create new alliances between hackers, cooperativists, neighborhood associations, leftist political parties, and others.

*Table 1*

<b>OVERVIEW OF TS-RELATED INITIATIVES</b>	
<b>Area of Action</b>	<b>Groups, Projects, and Initiatives</b>
Infrastructure and Hardware	Guifinet et al, The Things Network, CommonsCloud, Equipaments Lliures, Mar de Bits, Ateneus de Fabricacio
Software and Services	Coopdevs, Jamgo, Colectic, Adab1ts, Dabne, LliureTIC, Barcelona Free Software
Reuse and Recycling	eReuse.org/reutilitza.cat, Alencop
Cross-Sector Economic Activity	Katuma, SomMobilitat, Riders por Derechos, Voki Voki, SomConexio, Pangea, ITC Commission of XES
Education and Training	Colectic, ExO, Ateneus de Fabricacio, La Comunicadora, Alencoop, Smart Citizen/DECODE, Smart Barris, Universitat Lliure de Sants, Dimmons (Digital Commons Research Group, Open University of Barcelona)
Reflection and Theorization	SobTec, Mobile Social Congress, Calafou, La Teixadora, Dimmons

This dissertation broadly asks: are new digital technologies and infrastructures inevitably tools of surveillance, control, and capital accumulation? Or could they become loci for imagining alternative, more democratic futures? To answer these questions, I examine the diverse experimental practices, beliefs, and values of the TS movement in Barcelona, and operationalize my research through three core sub-questions that examine the contested production of economies, urban space, and subjectivities in the technological sovereignty community:

***SQ1)** How and to what extent do TS actors challenge, reshape, or reinforce existing economic relations?*

*SQ2) How and to what extent do TS actors shape urban space through their use of digital technology? On what forms of knowledge production and consumption do these practices rely?*

*SQ3) How do TS actors understand themselves as technological actors, in relation to hierarchies of technological expertise? How does this intersect with hierarchies of race, gender, sexuality, and other markers of difference?*

These questions allow me to explore how TS is imagined and produced as a spatially-situated discursive practice that iteratively reshapes the entangled relations among human and non-human actors that constitute urban life. The three sub-questions are meant to explore the various techno-social entanglements through which TS activities are carried out—from the extensively networked relations of economic production and exchange, to the more grounded relations of spatial production, to the immediately embodied and affective question of digital subjectivities. While these questions are individually the focus of the three articles attached as appendices, I attempt to highlight their entanglement throughout—recognizing that questions of economies, space, and subjectivities are inextricable from one another.

### **Theoretical Orientation**

The title of this dissertation, *Techno-Social Entanglements and Contested Urban Futures*, reflects the three primary theoretical trajectories that orient this research: the question of human-technological relations, urban space and politics, and the politics of futurity. While the individual papers that make up the bulk of the dissertation engage with these themes in different ways, the dissertation as a whole could be considered an extended examination on these three themes and their intersection. Below I offer an overview of these theoretical trajectories, and highlight how

they build on one another. I show how theories on the co-constitution of humans and technologies re-configure understandings of the constitutive relations of urban space. Both of these, in turn, open up possibilities for imagining and practicing a critical politics of futurity.

### *Techno-Social Entanglements*

Across the various parts of this dissertation is an extended examination of the evolving relationship between technology and humanity. Throughout the various sections of this dissertation, I make use of thinkers like Bernard Stiegler (1998; 2013) and Karen Barad (2007) to frame my specific arguments about the role of technology in producing and consuming knowledge and constituting differentiated subjectivities. Both of these thinkers, though in different ways, explore the constitutive role technologies play in human life, challenging any absolute ontological separability of the “human” from the complex material and technical environments in which humans are always already enmeshed and which they constantly re-shape through their work.

My reference to techno-social *entanglements* in the title and throughout the dissertation is a direct reference to Barad’s use of the term. She writes: “To be entangled is not simply to be intertwined with another, as in the joining of separate entities, but to lack an independent, self-contained existence. Existence is not an individual affair. Individuals do not preexist their interactions; rather, individuals emerge through and as part of their entangled intra-relating” (Barad 2007, p. ix). Key to Barad’s understanding of ontology as entanglement is the notion of the *apparatus*, or the practices through which such entanglements are iteratively reshaped. Barad (2007) describes apparatuses as “material-discursive practices—causal intra-actions through which matter is iteratively and differentially articulated, reconfiguring the material-discursive field of possibilities and impossibilities in the ongoing dynamics of intra-activity that is agency” (p.

170). Understanding ontology as entanglement and agency<sup>2</sup> as the work of apparatuses points to the co-constitution of humanity and technology. Human agency operates through everyday technics, the messy and complex intra-relations that inform and thereby re-shape, albeit temporarily, an ontology of entanglement. As I discuss different technical objects and systems throughout this dissertation, I approach them all through the lens of the apparatus—as more-than-human material-discursive intra-actions that iteratively produce difference in the world.

Stiegler's theory of *technogenesis*, or an originary technicity of Being, helps extend Barad's ontological project and elaborate on the constitutive role of technics. This notion of technogenesis is vital to disrupting narrow, deterministic conceptions of what technology *is* or *might be*. Similar to Barad, Stiegler understands technics as the inescapable relation through which humans and technology co-constitute each other—to speak of the human presupposes technology and vice versa. In the beginning of *Technic and Time, 1*, Stiegler lays out a critique of Aristotle's conception of *tekne* as separate from *episteme*—a discursive separation in which *tekne* becomes devalued as a mere means to an end. This separation allows for a juxtaposition between the living beings of biology and the inert matter of mechanics, in which technical objects are hybrids—inert matter given form or action through the agency of a living subject. Technical objects have no essence or identity of their own outside of their production by a knowing subject who puts them to use in the world.

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<sup>2</sup> Social scientific literature across disciplines has long debated the notion of “agency.” The long-running debates about structure vs. agency explore the relative ability of individual actors to affect change in the broader social structures within which they live (Chouinard 1997). In another move, scholars of science and technology studies like Latour (2005) and Bennett (2010) have argued that nonhuman objects, beings, and matter exercise agency through their material interactions in the world. Barad's apparatus moves beyond these debates by locating agency not in individual subjects or objects, but in the materio-discursive intra-actions through which subject and object are iteratively co-constituted.

In opposition to this view, Stiegler moves to theorize technics as constitutive of time and space. Time is experienced through “tertiary retentions” or the material objects and artefacts left behind from previous generations. For Stiegler, primary retention is the experience of perceiving an external object, secondary retention is the memory of previous perceptions, and tertiary retention is the externalization of memory in producing material objects in the world. This is the fundamental way the world is encountered and experienced, with each form of retention dependent on the others. The world is encountered, remembered, and reshaped—producing both *time and space*. Tertiary retentions—or technical objects—can thus not be seen as fully determined by human intention. They exist in the world, and indeed constitute the world long after the moment of externalization. Technical objects exist in a world that is different from the world in which they were produced, at the same time that they help produce those emergent differences.

For this reason, Stiegler calls for an understanding of “inorganically organized matter” blurring any distinction between the inert matter of mechanics and the active living matter of biology. As such, he contests the essential separability of subject and object, or of the *who* and the *what*, pointing to their continual co-constitution through relations. He writes:

Différance is neither the who nor the what, but their co-possibility, the movement of their mutual coming-to-be, of their coming into convention. The who is nothing without the what, and conversely. Différance is below and beyond the who and the what; it poses them together, a composition engendering the illusion of an opposition. (Stiegler, 1998: 141)

Significantly, Stiegler argues that the production of tertiary retentions—that is, externalization of memory—is also always constitutive of interiorization, or subject formation. There is no interior being that pre-exists its exteriorization in the world—“the interior is constituted in exteriorization” (Ibid: 141). The illusion of an opposition between subject and the world—of a knowing being preceding the world in which it is a part and in which it acts—is the product of an “originary



forgetting” which is the *aporia* of a desire for an origin where one does not exist or is not knowable. To make this argument, Stiegler follows the work of Leroi-Gourhan (1945) examining the evolution of the human species and the use of tools, showing how the human brain and skeleton both co-evolved with technology. Such an argument undermines any conception of technical objects as “prostheses” extending a given “natural” body, instead seeing these purportedly external objects as constitutive of the human as species. Indeed, what makes humans distinct as humans is the ability to transmit memory through tertiary retentions—to exteriorize memory in anticipation of future uses.

Stiegler’s work thus challenges reductive conceptions of technical objects as mere tools, while also not according them a kind of radical transcendent otherness. The question is not whether technology is the subject and humans the object, or vice versa, but rather how technology and humans co-constitute each other. The techno-optimism and techno-pessimism found in much recent work on emerging digital technologies can be traced to a fundamental misunderstanding of technics at the heart of Western thinking. By seeing technics as a means to human-defined ends—or alternatively, as seen in the discourse of the 4<sup>th</sup> industrial revolution discussed above, as a process over and above human ability to interact with it—Western thought has failed to understand the constitution of humanity and technology. The erasure of the originary relationship to technics obscures the experience of being-as-technics by positing the privileged position of the knowing subject. Both techno-pessimism and techno-optimism are positions that posit human relations to technology in terms of a subject-object dichotomy, fearing human subjection to technological systems and calling for the reassertion of human control of and direction over technology. Stiegler’s work reframes this relationship, allowing for a reflexive understanding of ourselves as

always already technical beings and open possibilities to experiment with that relationship in new ways.

### *Urban Space and Politics*

Stiegler's theory of technogenesis and Barad's notions of entanglement and apparatuses both have clear implications for geographic theories of space. Barad (2007), for instance, writes: "Spatiality is intra-actively produced. It is an ongoing process of the material (re)configuring of boundaries—an iterative (re)structuring of spatial relations" (p. 181). Geographic theories of spatiality have long argued that space is iteratively and continually produced in practice (Lefebvre 1992; Massey 2005). More recently, geographers have begun to recognize the constitutive roles of nonhumans—from nature to technological apparatuses—in this ongoing production of space (Kitchin and Dodge 2005; Amin and Thrift 2017). This dissertation relies on a theory of urban space that recognizes its continual emergence and production through ongoing processes of intra-action among a range of human and nonhuman actors—from planners, municipal officials, and urban residents, to complex urban environments and material infrastructures increasingly controlled by assemblages of hardware, code, and data (Amin and Thrift 2017).

This shift in geographic thought around the city has often been referred to as assemblage urbanism (McFarlane 2011) and has led to detailed analyses of the constitutive relations of cities and urban life in particular contexts. For instance, McFarlane (2016) highlights the relationships among urban infrastructure, human waste, and bodies in producing social inequality as well as possibilities for urban protest in Cape Town, South Africa. Shaw et al (2010) compare practices of mosquito management in Tucson and Phoenix, Arizona, highlighting the roles of "managers, institutions, and sociocultural-environmental-technological-political contexts" along with

mosquitoes themselves in constituting different outcomes. Tironi and Valderrama (2018) highlight assemblages of humans, bicycles, digital devices, and data in a smart city biking program in Santiago de Chile. All of these examples employ detailed description of material relationships and processes in urban life.

Yet, the development of this post-human conception of the city in urban geography has led to a prolonged debate between Marxist and neo-Marxist thinkers and the emerging literature based around “assemblage-thinking.” Scholars of critical urban political economy have argued that assemblage conceptions of the urban life offer only a “naïve objectivism” while abandoning a critique of capitalism and the structures that constitute the “context of contexts” in which local urban processes are positioned (Brenner et al 2011). While these scholars largely fail to engage with the ontological arguments<sup>3</sup> put forth by assemblage and related theories of the city, their critique raises an important question about the politics of assemblage urbanism—that is, how to understand politics as practice in a more-than-human city. Indeed, too often the politics of this post-human view of the city are left undertheorized—with scholars vaguely highlighting the possibilities for emergence or moments of rupture in the processes of more-than-human becoming.

As Rose (2017) argues, most recent work on digital technology in geography has focused on the agential capacities of technology and other nonhuman actors while undertheorizing (post)human agency in urban life—re-asserting it as a resistance *against* technology. In other words, this work fails to fully account for the co-constitution of technics and humanity. To the extent that other work in assemblage urbanism and related more-than-human theories has faced a

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<sup>3</sup> The debates over assemblage theory in urban geography can be seen as the extension of earlier debates over the place of “scale” as a concept in human geography, with proponents of a flat ontology arguing that conceptions of scale work to obscure the spatially-situated practices and actions through which the world is made and re-made (Marston et al 2005).

similar problem, the failure to fully theorize post-human agency helps account for this literature's sometimes ambiguous politics.

Rose (2017), therefore, argues for a conception of posthuman agency in the digitally-mediated city in which humans work to re-shape the constitutive relations of the city—enacting alternative temporalities and spatialities. This reflects Stiegler's focus on ongoing practices of *reinvention*, and Barad's notion of apparatuses as material-discursive practices of intra-action. Farías (2011) makes a similar argument in his articulation of the politics of assemblage approaches to the city. He writes: “the political project this perspective involves is connected with a redefinition of democracy towards participatory practices that might eventually recognize and represent humans and nonhumans as political actors” (Farías 2011, p. 371). An urban politics that recognizes the more-than-human constitutive relations of urban life involves practices of creative re-invention and experimentation—constituting alternative apparatuses in Barad's terms, or re-articulating complex urban assemblages.

### *Futurity*

This dissertation is also inspired by the question of the future—of the kind of urban futures that are being constructed around the globe, and in Barcelona in particular, with the development and proliferation of new digital and networked technologies. Working through Barad's (2007) ontology of entanglement implies a recognition of a future as undetermined, with multiple possibilities that are iteratively emergent. She writes that “intra-actions iteratively reconfigure what is possible and what is impossible—possibilities do not sit still. One way to mark this is to say that intra-actions are constraining but not determining” (p. 177). Likewise, Urry (2016) stresses that “[t]he future is neither fully determined, nor empty and open” (p. 12). As such “a key element of power is thus power to determine—to produce—the future, out of the many ways it is imagined,

organized, materialized and distributed” (Urry 2016, p. 17). The attempts by techno-capitalists to secure particular futures may reconfigure what is possible, but can never foreclose the possibilities for something radically different.

Following Urry (2016) and Kinsley (2010) I consider the evolving human-technological relations and the production of urban space as part of a “socio-technical politics of anticipation in which particular visions of the future are rendered present through the production of material infrastructures and artefacts... preemptively establish[ing] relations of power in an undetermined future” (Sammler and Lynch 2019, p. 6). Such anticipatory action has increasingly become a key way power is exercised in the contemporary world, as states, companies, and communities pursue ever more complex strategies for predicting and securing against possible futures. The drive to produce and analyze data about all aspects of social, political, and economic life has been at the heart of these forms of prediction and securitization over the past several decades. Proponents of big data analytics aim to make the future knowable and controllable by monitoring and constaining the complex dynamics of the present.

In this sense, I aim to extend recent literature in geography—and urban geography in particular—on the question of the future. Anderson (2010), for instance, examines how the future becomes posited as a problem or threat to liberal democracy, and therefore the object of anticipatory governmental action. In the case of cities in particular, scholars have examined how policymakers and planners imagine utopian urban futures in the case of rapid urbanization across much of the global South—demonstrating a desire to break with the intractable problems of existing cities (Datta 2018b; Lynch 2018). In contrast, Leszczynski (2016) approaches “urban algorithmic governance and governmentality as material-discursive projects of future-ing, i.e., of anticipating particular kinds of cities-to-come,” highlighting the way smart city and related

projects are explicitly focused on the future—specifically in guarding against futures “deemed undesirable or deleterious” (p. 1692). In another sense, the rise of ‘post-political’ technocratic urban governance more broadly can be understood as a project of constraining the possible imaginaries of urban futures by policing a narrow consensus as to what constitutes good governance and the goals of urban development (Davidson and Iveson 2015).

Urry (2016) highlights the importance of future-thinking to governments, corporations, NGO’s, universities, and all manner of organizations and collectives. In the contemporary conjuncture, powerful actors from Silicon Valley and the tech industry more broadly have come to exert considerable influence both over the way the future is imagined, as well as the development of key material infrastructures that aim to bring about particular visions of the future. Irani (2018), for instance, highlights the rise of “design thinking” within Silicon Valley, explaining that “design thinking teaches corporate workers to tell stories about the lives of potential customers and imagine different futures for them” (p. 3). She goes on to examine the emergence of design thinking as the production of new forms of expertise, in order to secure Silicon Valley’s future as the geopolitical center of the global technology sector. Kinsley (2010) describes the way companies like Microsoft and HP Labs produce promotional videos of as-yet-nonexistent technologies as a way to “encourage a familiarisation and embodied disposition towards proposed futures” (p. 2772). He argues that “[t]hese videos, when watched, rescript the ‘indeterminate potentiality’ (Massumi, 2007) of the future by performatively establishing the presence of what has not happened and may, in fact, never happen” (Kinsley 2010, p. 2771). Such practices work to limit what kinds of futures are seen as possible and desirable.

Returning to the example given at the beginning of the dissertation, the discourse of the 4<sup>th</sup> Industrial Revolution propagated by powerful interests in business and policymaking alike

represents a totalizing imaginary of the future—subordinating all aspects of life to the exigencies of the technology industry. This narrow vision of the future is secured through the proliferation of corporate technologies into the material infrastructures and systems through which everyday life is re-produced, exemplified by the smart city paradigm. Kitchin and Perng (2016) highlight the totalizing nature of this process, writing: “The speed of technological innovation and material deployment, and the power of the discursive regimes driving their adoption is outpacing and outflanking critical reflection and intervention” (p. 2). Techno-capitalist interests are gaining control of vital systems, including the entangled systems of the city, while foreclosing critical debate about what kind of future is being built, its desirability, and possible alternatives.

Against this totalizing vision of the future and the material-discursive practices of the tech industry and their partners that enact that vision, this dissertation calls for alternatives. I aim to open up the digital urban future posited by the smart city to new imaginaries, and highlight the alternative material-discursive practices that reconfigure the constitutive relations of urban life to make those imaginaries possible. In doing so, I am inspired by the work of scholars like Muñoz (2009) and Marez (2016). Muñoz calls for a critical re-imagining of possible futures, or a “critical utopianism” based around notions of queerness, writing: “The future is queerness’s domain. Queerness is a structuring and educated mode of desiring that allows us to see and feel beyond the quagmire of the present. The here and now is a prison home. We must strive, in the face of the here and now’s totalizing rendering of reality, to think and feel a then and there” (p. 1). While Muñoz focuses primarily on the need to think beyond present hegemonic conceptions of gender and sexuality, such conceptions of queerness have been adapted to theorize the indeterminacy and potentiality of social futures more broadly.

Adapting Muñoz's notion of queer futurity, Marez (2016) examines the practices of California farmworker organizers who imagine alternatives to agribusiness's vision of the future based on high-tech capitalism and the increased surveillance and eventual displacement of racialized workers. Marez describes the movement's use of "technologies from below"—including video production technologies—to re-configure apparatuses of surveillance and control for the production and spread of such alternative visions. He also considers the work of several artists and films that imagine futures constituted around alternative political economic and social systems, including an end or reversal of racialized hierarchies. Marez writes that "the collective contexts of such farm worker futurisms mark them as utopian alternatives to agribusiness futurism and its idealization of technology in the service of labor exploitation and private property" (p. 27). This dissertation takes a similar approach to the contesting the narrow visions of the future of urban life projected for Barcelona and cities around the world by large technology firms, governments, planners, and consultants.

### **Study Site: Barcelona**

Barcelona is an ideal site to study the competing visions of the future of the digital city, life, and technology. Since 2011, the city has become a leader of the global smart city movement in urban planning and governance. Barcelona is special, though, because the city also has a long tradition of radical politics and grassroots democracy. This creates a complex tapestry of digital activity that challenges the straightforward teleology of technological progress in the smart city. In situating the emergence of the movement for technological sovereignty (TS) in Barcelona, it is vital to examine the historical influences that partially structure the city today. These include: the city's history as a hub of anarchist and left-libertarian movements through the late 19<sup>th</sup> and early



20<sup>th</sup> century, the city's history of neighborhood-based politics and community organizing throughout the 1980's, and the city's role in the anti-globalization movements of the early 2000's and in the 15M occupations of 2011.

### *Anarchist Barcelona*

Barcelona is a city with a long history of radical politics. Perhaps most famously, the city was home to large and influential anarchist workers' movements in the late 19<sup>th</sup> and early 20<sup>th</sup> century, up to the 1936 Revolution and the eventual triumph of Fascist forces in the Spanish Civil War. The social roots of these radical movements have been the focus of much historical analysis. Oyón (2009), for instance, argues that recent migrant laborers from southern Spain and the neighborhoods where they resided formed the popular and territorial basis for radical organizing between 1914 and 1936. He argues that the territorial, neighborhood-based organization of the movement was key to its formation. Smith (1997) highlights the movements' longer history, focusing on the primarily Catalan working class in the first decades of the 20<sup>th</sup> century. Analyzing the characteristics of this working class, Smith finds that 50% of male workers in 1905 had completed an apprenticeship and worked as skilled laborers in artisanal trades. In particular, he examines the role of labor organizing amongst skilled workers battling processes of technological change aimed at de-skilling and de-valuing labor in driving the growth of the anarchist workers' movements.

Indeed, multiple accounts of the anarchist workers' movement in Barcelona highlight the important role of science and technology in the movement, as organizers sought to democratize knowledge and demonstrate the ability and intelligence of the working class (Girón Sierra and

Molero-Mesa 2016). The network of local athenaeums<sup>4</sup> (or *ateneus* in Catalan) served as community spaces for cultural events, popular education, training, and organizing (Ealham 2008). Smith (2002) highlights the important role of technology in the subculture of the athenaeums, writing: “It was after all upon technological and scientific progress that the new world was to be forged” (p. 32). Thus, while the anarchist labor organizers recognized the role of technology in de-skilling and de-valuing labor, they did not reject technology, but rather sought to democratize and socialize it.

Such forms of labor organizing and popular education laid the foundation for the city’s experiment with anarchism during the Spanish Civil War, immediately following the 1936 military coup d’état overthrowing the Second Spanish Republic. Smith (2002) explains that: “The military uprising sparked a working-class revolution in the city [Barcelona] and throughout urban Catalonia, which can be seen in many respects as the culmination of the anarchist tradition” (p. 10). Following the revolution, the state collapsed, churches were ransacked, and industry was collectivized, run by a series of worker committees. In his memoir from the Spanish Civil War, *Homage to Catalonia*, George Orwell (2015: p. 87) writes of Catalonia during this period:

I had dropped more or less by chance into the only community of any size in Western Europe where political consciousness and disbelief in capitalism were more normal than their opposites... In theory it was perfect equality, and even in practice it was not far from it. There is a sense in which it would be true to say that one was experiencing a foretaste of Socialism. Many of the normal motives of civilized life—snobbishness, money-grubbing, fear of the boss, etc.—had simply ceased to exist. The ordinary class division of society had disappeared to an extent that is almost unthinkable in the money-tainted air of England.

Eventually anarchist influence in Civil War Barcelona faded as the Republican government slowly re-constituted itself following the 1936 coup d’état, and was later defeated by the Fascist forces of

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<sup>4</sup> Defined by Merriam-Webster as “a building or room in which books, periodicals, and newspapers are kept for use; a literary or scientific association.”

General Francisco Franco leading to thirty-six years of dictatorship. Yet, the success of anarchist organizing in the early 20<sup>th</sup> century, and the movement's role in fighting Fascism during the Spanish Civil War helped establish a left-libertarian tradition in urban politics in Barcelona that is still evident in contemporary forms of political organizing and action, including the TS movement.

### *Neighborhood Politics and The Barcelona Model*

With the death of Francisco Franco in 1975, Spain began a transition to liberal democracy, with the first municipal elections held in 1979. The waning and eventual end of the dictatorship gave rise to powerful neighborhood-based political movements throughout the 1970's demanding social services and more de-centralized, democratic forms of governance. Blanco (2009) explains: "These movements demanded better social housing and the remodeling of the existing housing stock; improvement in public education, sanitary and health services; improvement in public transport services and road safety; more public spaces; more cultural activities; and political freedom" (p. 357). Many neighborhood movements drafted *Plans Populares* [People's Plans] for urban regeneration specific to each neighborhood, posing an alternative to the centralized forms of urban governance and planning characteristic of the municipal politics during the dictatorship.

These neighborhood movements gained significant political influence by building alliances and coalitions with urban professionals, planners, and the re-emerging political parties. While these movements were not necessarily as radical in their political ideology as the early 20<sup>th</sup> century anarchist movement, they similarly stressed de-centralized, territorially-based forms of local self-government (Blakely 2005). The power of the neighborhood associations and the form of participatory government they helped enact became key to what would become known as the "Barcelona Model" of urban development (Degen and García 2012).

The "Barcelona Model" has come to symbolize a unique approach to urban re-development

characterized by the integration of social and cultural demands in development projects, the re-generation of public space and infrastructure, broad participation and consensus across a range of urban actors, and the leveraging of large international events to attract investment—most notably the 1992 Olympic Games (Garcia-Ramon and Albet 2000; Monclús 2003; Marshall 2010). Degen and García (2012) trace the evolution of the so-called Barcelona model, highlighting the waning of popular control and the influence of the neighborhood movements, particularly in the run-up to the Olympic Games. They argue that the early years of the transition—roughly 1979-1985—were characterized by decentralized democratic politics, but that this gave way to consensus building in the late 1980's, and later to more top-down forms of governance. While these later forms of governance continued to stress citizen participation and cultural production in urban development, these features came to function as a tool of a centralized development strategies centered around building the city's "brand" internationally.

Thus, while the Barcelona Model of urban governance and development has been celebrated internationally, it has drawn significant criticism from local observers and social movements. Delgado (2007), for instance, argues against the common periodization of urban politics in Barcelona focused on the "transition" to democratic government, instead highlighting the *continuity* in urban development priorities and plans from the dictatorship to electoral democracy. He argues that supposed success of the Barcelona Model has always been predicated on selling the city to private real estate interests to the detriment of working class communities, continuing a process begun under the leadership of Josep Maria de Porcioles, the city's mayor during much of the dictatorship. The dominance of private interests has only become more pronounced in the past decades, with the global shift toward neoliberal forms of "entrepreneurial urbanism" (Peck 2014). Charnock et al (2014), for example, examine Barcelona's drive to become

a global “knowledge city” since 2000, seeing it as “an exercise in the capture of monopoly rents” (p. 198) and an example of the limits of the Barcelona Model in the context of neoliberal urbanism.

What these debates about the Barcelona Model make clear is that struggles between centralized urban planning initiatives and decentralized, neighborhood-based politics is nothing new in Barcelona. Indeed, such struggles have played a major role in shaping the development of the city over the past four decades. The competing discourses of the smart city and technological sovereignty, and the different institutions and forms of organization on which they are based, can be understood as the continuation of this struggle in the contemporary conjuncture.

*Contemporary Political Organizing: Alter-Globalization, Anti-Austerity, and Free Knowledge*

Over the past two decades, Barcelona has become an important node in various national and international progressive political movements. Juris (2010), for instance, highlights the role of Barcelona-based activists in the anti-corporate globalization movements of the early 2000’s. The Movement for Global Resistance (MRG) was an international network organizing protests against the World Bank and International Monetary Fund, the World Trade Organization, the G8, and other large gatherings of the world’s political and economic elite. Since 2001, counter-globalization activists meet each year in the World Social Forum in Brazil to challenge neoliberal hegemony and promote alternative forms of political, social, and economic organization. Barcelona has been an important base of organizing and support for the movement, with a large community of activist collectives and social economy initiatives building cooperative economies.

Juris (2010) discusses the role of anarchism among Barcelona-based activists in the MRG, showing how anarchist ideals of de-centralization and self-management evolve under new conditions:

At one level many radicals in Barcelona continue to draw on the city’s anarchist legacy as an inspiration for present day struggles. At the same time, the history of anarchism together

with the influence of Catalan nationalism has contributed to a unique culture of opposition characterized by grassroots participation, decentralization, and self-management... The critical divide is not so much anarchist versus socialist, but rather institutional versus grassroots strategies for social change. (p. 153).

In other words, while present-day political struggles in Barcelona cannot be understood as the direct continuation of earlier anarchist organizing, a certain left-libertarian ethic continues to shape organizing strategies and the projection of alternative futures for Barcelona-based activists—from the neighborhood movements discussed above through the new globally-networked movements of the 21<sup>st</sup> century.

Throughout this period, Barcelona has also been an important site of development for the Free Culture or Free Knowledge Movement (Fuster Morell et al 2015)—a global network of activists working to harness the internet to promote open access to information, battling emerging regimes of national and international intellectual property law. Fuster Morell (2010) defines the Free Culture Movement as:

a network of individuals and organizations, linked by more or less dense networks, solidarity ties and moments of confluence, sharing a loose collective identity and a common set of values and principles (most importantly accessibility and the flow of information and knowledge, creativity, participative formats, network settings and communal ownership), whose acting together aims to challenge forms of knowledge-making and accessibility by engaging in the construction of digital commons and mobilizations directed against the media and cultural industries, their lobbies, and political institutions (at the national, regional and global levels).

This included movements for Free and Open Source Software (Söderberg 2015), as well as the sharing of cultural material. Activists concerned about the privatization of knowledge and culture implemented new regimes and practices for protecting open-source and free culture, including ‘copyleft’ and Creative Commons licensing. This movement takes as a primary concern the democratization of the digital revolution—seeing in new technologies the tools necessary to build alternative, de-centralized political, economic, and social practices.

Fuster Morell (2012) explains how the Free Culture Movement, in confluence with earlier

generations of neighborhood-based and alter-globalization activists came to play an important role shaping the *indignados* or 15M movement in 2011. The *indignados* occupied public squares across Spain in 2011 in protest against government austerity measures taken in response to the global financial crisis. The occupied squares became sites for theorizing and organizing alternative social, political, and economic practices based around solidarity and common well-being. The movement called for a deepening of democracy and new forms of popular control, and made particular use of social media and the internet to organize actions and build extensive solidarity networks with activists across Spain and the globe (Barbas and Postill 2017). The Free Culture Movement was key in implementing alternative practices of communication, cultural production, and knowledge sharing in the context of the 15M protests (Fuster Morell 2012).

These contemporary movements demonstrate the evolution and confluence of historical traditions of anarchism, place-based urban politics, extensive solidarity activism, and technology activism in Barcelona. Throughout these examples, Barcelona-based activist strategy has stressed the importance of promoting forms of de-centralized, democratic organization. As I make clear in the three attached articles, these historical influences play a role in shaping the emergence of technological sovereignty as a de-centralized movement of political practice.

### **Methodological Framework**

This is a qualitative study of a grassroots techno-social movement in Barcelona, focused on interrogating how activists imagine and build alternative urban futures through their engagements with digital technology. As Cope (2019) argues: “Qualitative digital geographies are needed to interrogate and make sense of how we produce, experience, and *know* emerging digital worlds” (p. 97, *emphasis in the original*). Following the theoretical orientation of this project discussed above, I am interested in the daily practices through which the posthuman material-

discursive relations of urban life are reiteratively reshaped and emergent. As such, I employed an ethnographic approach based on a combination of qualitative methods, including participant observation, semi-structured interviews, and discourse analysis. This combination of methods allows me to understand both the experimental practices and forms of social organization through which TS activists work, as well as the discourses about the city, technology, and the self that inspire those actions and are iteratively remade through them.

### *Ethnography and the Study of Digital Life*

Across and within social science disciplines there are competing conceptions as to what constitutes ethnographic research. For some, ethnography is a rigorous practice with more or less set standards for where research should take place, how that place is to be defined and understood, the appropriate place of the researcher, how long the researcher should remain in the “field,” what kinds of notes should be kept, and how that data should eventually be presented. Ethnographic practice in sociology and political science, for instance, has been used to supplement and “verify” other ways of knowing or accounting for social and political phenomena (Baiocchi and Connor 2008). In contrast, for Henderson (2016), McGranahan (2014) and others, ethnography is less a hard set of practices and rules and more a *sensibility* or way of seeing, experiencing, thinking, and relating to the world that is compatible with a wide range of research practices and methods. Such an ethnographic sensibility and the iterative flexibility of ethnography are ideal for exploring questions of digital life in the contemporary world, characterized by fragmented and multiple space-times and the proliferation of modes of communication and socialization.

Within the emerging digital geographies literature, scholars are only beginning to employ and think through the importance of ethnographic research. Many of the shortcomings in the sub-



discipline at the current moment—including its undertheorized notion of (post)human agency (Rose 2017), digital subjectivity (Elwood and Leszczynski 2018), and politics (Lynch 2019)—can be best addressed through ethnographic research that aims to understand how individuals and communities differentially experience and interact with digital technologies in their everyday lives. For instance, Pink and Fors (2017) conduct ethnographic research to understand how self-tracking technologies reshape daily practices and experiences of urban space. By following the practices of people using self-tracking technologies in Australia and Sweden—and creating opportunities for research subjects to reflect on and discuss their practices and motivations—the authors are able to offer a more intimate and nuanced discussion of the complex human-technical assemblages emerging in the contemporary conjuncture.

While geographers have definitely been interested in thinking through ethnography in many areas, its use when examining digital life is still more common in anthropology. Gabriela Coleman (2014), for example, has conducted extended ethnographic research with hackers, including the well-known and secretive collective Anonymous. In her book on the Free and Open Source Software (F/OSS) movement, Coleman (2012) also describes the challenges of conducting ethnographic fieldwork on a decentralized, informal community organized around ‘technical’ work. To do this work, Coleman honed her own technical skills, integrated herself into social circles of hackers, and attended meetings of hackers in specific places—mostly San Francisco. At the same time, she participated in numerous digital forums and projects, building new relationships with hackers across the world. Hine (2015) highlights the importance of the internet to all ethnographic practice in the contemporary world. As digital technology and the internet come to reshape everyday practices across the globe, ethnographers need to recognize and work through the ways offline and online practices become increasingly entangled.

### *Summary of Methods and the Fieldwork Period*

Fieldwork for this project took place over two periods between 2016 and 2018. The first, preliminary period of fieldwork, was carried out between May and August 2016. During this period, I began informal conversations with representatives from various TS-related initiatives and, in a few cases, conducted more formal semi-structured interviews (six of which are included below in Table 3). Through these conversations, I established contacts that allowed me to design the primary fieldwork period, identifying future individuals for interviews, events to attend, and three specific initiatives for sustained participant observation.

In this project, my approach to ethnography has made use of a combination of qualitative methods, including participant observation and semi-structured interviews. I also collected a broad range of written materials, from published manifestos to blogs, websites, op-eds, and promotional pamphlets related to TS or the broader politics of digital development in Barcelona. While this is detailed below, the majority of this work is methodologically informed by my participant observation of the growing TS movement in the city. My approach to participant observation included sustained, repetitive observation and engagement with three primary collectives or initiatives: 1) Guifinet, 2) Ateneus de Fabricació, and 3) the SobTec organizing committee. These groups were selected both based on access, as well as for their diverse forms of organization and position within the broader TS networks. Throughout this time, I took detailed fieldnotes on my interactions and observations with each group, highlighting the diversity of practices, forms of organization, and common discourses through which the different groups operated and networked with others around the city.

- 1) Guifinet is the largest and most established of the projects. It is a community wireless network composed of more than 35,000 active nodes spanning across Catalonia and into neighboring regions of Spain. The project is organized territorially, with decentralized Guifinet associations building and maintaining their own broadband internet infrastructure in the neighborhoods and towns where they live. I participated in Guifinet activities by attending weekly “guifilab” meetings held around Barcelona in which members of the network plan and discuss the expansion of the infrastructure. I also joined the local association for my neighborhood and attended monthly meetings to help plan and manage the network. I installed a “node”—or wireless connection point—in my own home using Guifinet manuals and regularly participated in group text chats about the management of my local network.
- 2) The Ateneus de Fabricació (AdF) are a network of public 3D printing labs operated by the municipal government. Inspired by the legacy of the early 20<sup>th</sup> century athenaeums, the spaces offer open access to advanced digital production technologies for neighborhood residents. I conducted regular participant observation at workshops, meetings, and courses in the AdF in the Ciutat Meridiana neighborhood, and attended special events at AdFs in the Barceloneta and Les Corts neighborhoods over the course of my field work. These observations allowed me to see the various ways different groups in the city make use of the space, and to follow individual subjects through the process of learning to use the devices for different purposes.
- 3) The SobTec organizing committee is an informal group of 5-10 individuals who meet regularly throughout the year to collectively theorize and promote technological sovereignty and to organize the annual SobTec congress. Group members would debate and discuss questions of privacy, ethics, and politics in relation to digital development and would work to articulate a coherent notion of technological sovereignty by reflecting on the practices of local initiatives and

associations. The group generally met once a week in La Lleialtat Santsenca, a municipal-owned, cooperatively-managed community space in the Sants neighborhood of the city. I regularly attended these meetings throughout my fieldwork period in order to better understand how the diversity of community-based digital projects being carried out around the city might be articulated under a common vision or ethic.

In addition to my observation of these three groups, I also conducted participant observation at a series of one-off events, workshops, and meetings—outlined in Table 2 below. These events and meetings span a range of sizes and formats, and included both mainstream smart city events, as well as critical and TS-related events. Some of these were events open to the public at which discussions of digital technology and urban politics were featured, while others were more closed events or meetings of individual collectives or gatherings of multiple collectives. Participating in these events allowed me to gain a more complete perspective on the diversity of projects related to TS and how they are situated within broader municipal digital politics. During these events, I took detailed fieldnotes to understand how TS as discourse and practice evolved or took on new meaning in different contexts and how it contested or related to more mainstream discourses of digital innovation.

*Table 2*

<b>EVENTS, WORKSHOPS, MEETINGS</b>		
<b>Date</b>	<b>Organizer</b>	<b>Explanation</b>
19 June 2017	Barcelona en Comú	Film screening and discussion hosted by the governing party in Barcelona reflecting on their first two years in power, including the changes to the city's smart city program.
26 June 2017	Escola del Comú	Debate on the digital commons with economist Yochai Benkler, Barcelona councilwoman Gala Pin, Dr. Mayo Fuster Morell (Universitat Oberta de Catalunya), and Barcelona Digital Commissioner Francesca Bria
6-7 October 2017	Escola del Comú	Two-day event with a variety of panels and speakers on municipalism and the urban commons, including

		panels on digital innovation, sovereignties, online resistance, and technopolitical networks.
21-22 October 2017	Xarxa de Economia Solidaria (XES)	Two-day event. The Solidarity Economy Fair of Catalonia (FESC) brings together cooperative and commons-based enterprises from across the region, with a sub-area devoted to groups working with digital technologies (TECNOFESC)
5 November 2017	FairCoop Catalunya	Presentations and discussion organized around FairCoin—an experiment in democratically-managed, ecologically-responsible cryptocurrency.
6 November 2017	Barcelona City Hall	Digital Commissioner Francesca Bria presents “New Measures for Open Digital Governance”
16 November 2017	Smart City World Expo	Large annual meeting of municipalities and technology companies involved in developing new smart city infrastructures and initiatives.
21 November 2017	La Comunicadora	Open-House event for La Comunicadora, a municipal-sponsored project meant to organize and jump-start cooperative and commons-based enterprises, including many digital and platform-based enterprises.
29 November 2017	Eurecat	Annual one-day event organized by the Centre Tecnològic de Catalunya focused on the technological needs and challenges faced by small businesses.
30 November 2017	Barcelona City Hall	Public participation and debate event for Repensem 22@, re-developing neighborhood plans for Poblenou.
20 January 2018	Comité per la Defensa de la República (CDR)	A workshop on digital surveillance and alternative practices organized by the CDR for Horta-Guinardó.
25 January 2018	Lluiretic	Meeting of local programming cooperatives and associations to reflect on common needs and areas for collaboration and expansion.
25 January, 7 February 2018	The Things Network (TTN) Catalunya	Working meetings of The Things Network to organize in lead up to public workshop.
8 February 2018	Barcelona BitCoin Community	Presentation by BitCoin activist Amir Taaki on the possibilities to capture BitCoin for progressive and radical aims.

9-10, 16-17 February 2018	Barcelona City Hall, Colectic, Dabne	Four-day workshop on “Digital Political Participation,” including exploration of TS and open-source alternatives and ongoing municipal projects.
14 February 2018	CommonsCloud Alliance	Meeting of various local programming cooperatives and associations to strategize a joint project to start a commons-based cloud infrastructure.
20-24 February 2018	Mobile Week Barcelona	A series of public debates, speakers, and workshops on topics related to digital innovation, politics, urban development, and ethics.
23 February 2018	Anti-Mobile World Congress	Public debate about the precariousness of work in the app-based gig economy.
26-28 February 2018	Mobile Social Congress	Annual event hosted by SETEM-Catalunya to raise awareness of the abuses of the capitalist mobile industry and promote TS-based alternatives.
3 March 2018	III Congrés de Soberania Tecnològica (SobTec)	Annual event to promote and theorize technological sovereignty. Including panels, speakers, and workshops on: transversal sovereignties, the intersection of food and technological sovereignties, net neutrality, ethics in artificial intelligence, critical approaches to gamification, and platform cooperativism, among others.
16 March 2018	The Things Network (TTN) Catalunya	Public Co-Creation Workshop to strategize and plan a commons-based Internet of Things network.
16 April 2018	Dimmons and Barcelona City Hall	Meeting of TS-initiatives with representatives from Barcelona City Hall and the Digital Commons Research Group.

Over time, and through the development of connections, I also conducted 23 semi-structured interviews (outlined in Table 3) with representatives from across different organizations and initiatives in the broader TS movement. These interviews were framed around a few broad questions focused on: (1) the history, future goals, practices and forms of organization through which each group operates (2), the individual’s background, experience, and motivation for participating in the particular group in question, and (3) their understanding of technological sovereignty as a concept, its potential and current shortcomings. The participants ranged in age

and experience with the TS movement—from relative newcomers with little formal “technical” training, to those with several decades of experience in hacker movements or professional technical careers. The subjects are roughly split in gender, with 12 subjects identifying as men and 11 as women.

Table 3

<b>LIST OF INTERVIEWS</b>		
<b>Name/Pseudonym</b>	<b>Organization/Initiative/ Collective</b>	<b>Date</b>
Teo	Xnet	18 July 2016
Jordi	Ateneus de Fabricació	25 July 2016
Albert	Ateneus de Fabricació	28 July 2016
Peter	Guifinet	28 July 2016
Montse	SomConexió	15 August 2016
Silvano	SmartBarris	17 August 2016
Guillem	GuifiAmunt	21 September 2017
Sergio	Coopdevs	29 January 2017
Mauricio	Decidim	7 October 2017
Manuel	FairCoin	5 November 2017
Laura	Ateneus de Fabricació	25 October 2017
Rosa	LaMoscaTV	25 October 2017
Pep and Ana	Colectic	20 November 2017
Pau	Coopdevs	29 January 2018
Oriol	Lliuretic	29 January 2018
Irene	Dabne	16 February 2018
Miguel	RidersxDerechos	4 March 2018
Laia	SETEM-Catalunya	15 March 2018
Martha	Jamgo	16 March 2018
Nuria	Colectic	21 March 2018
Maria	La Mar de Bytes	2 April 2018
Chris	Equipaments Lliures/Lleialtec	3 May 2018
Alba	Pam a Pam	18 May 2018

While these experiences detailed above refer to in-person research experiences, my ethnographic practice involved participation in both in-person and online environments. While many TS initiative may meet only once or twice a week (and some less frequently than that), various digitally-mediated forums create spaces for ongoing day-to-day discussions within and across different collectives. I thus participated in a series of email listservs and online forums

through applications like Telegram, Signal, and Riot—including group chats for the Barcelona Guifilabs, my local Guifinet association, the SobTec organizing group, as well as a general forum for the broader TS community with over 80 members. During this time, I kept detailed fieldnotes about the kinds of conversations taking place on these forums—from everyday questions of maintaining infrastructure or setting meetings time, to more intense political and philosophical debates.

Finally, I collected, read, and analyzed documents, manifestos, blogs, and websites from TS activists and initiatives, including the two dossiers on technological sovereignty (Hache 2014; Hache 2018) and the collectively-authored book *Sobirанийes* (Benitez Romero et al 2017). These various texts allowed me to engage deeper with the way TS activists and the broader movements with which they are networked understand their own work. As these texts are read broadly across the TS movement, they also allow me to better understand the different kinds of materials through which individuals and collectives within the movement come to think through and theorize their own practices.

### *Data Analysis*

Throughout my fieldwork, I amassed an archive of qualitative data, including the fieldnotes from my participant observation, the recordings and transcripts of my interviews, and an array of documentary and visual sources—from manifestos and webpages, to promotional posters and flyers. I qualitatively coded these materials to extricate the primary themes of the three attached articles: the production of economies, space, and subjectivities in the TS movement.

To examine the movement's economic practices and relations, I recognize economic relations as performative—that is, that economies are constituted through embodied daily practices in place through which individuals and collectives exercise different forms of production and



consumption and re-produce notions of work and property (Gibson-Graham 2006; Callon 2007). I thus sought to highlight in my data the ways TS activists practice and experiment with alternative forms of labor, production, consumption, or property in their digital projects. In keeping with this framework, I also recognize TS activists' own discourses about these economic practices as forms of grassroots theorization that iteratively produce new relations and subjectivities. I thus coded my data to highlight the values, beliefs, and motivations that inspired and informed such alternative practices beyond the capitalist drive for profit. This allowed me to highlight the foundations of an alternative economic practice at the heart of the TS movement (Appendix A).

To examine the production of urban space in the actions of the TS movement, I employ a range of theories that approach urban space as always in the process of being produced. Lefebvre (1991) famously argued that space was continually produced through the interaction among: the diverse forms of representing, planning, and producing knowledge about space; the daily spatial practices or flows of people, goods, energy, and capital across space; and the subjective, embodied, emotional, and symbolic experience of being in space. More recent literature on the “automatic production of space” (Thrift and French 2002) highlights the way all three of these aspects of spatial production are increasingly mediated by technical objects and systems. Thus, to understand the production of space in the TS movement, I highlight moments in my data in which TS actors produce and consume knowledge about the spaces of the city, or actively reshape those spaces, through their grassroots digital project.

Finally, to consider how the TS movement works to shape subjectivities in relation to digital technology, I employ an understanding of subjectivity as embodied and performative. That is, subject positions are not stable and singular but—like economies and space—actively (re)produced through daily practices involving an array of human and nonhuman actors (Barad

2007; Butler; 2011; Braidotti 2013). I thus highlighted moments in the data where individuals came to take on new roles in technological projects through experimental practices, or moments in workshops and courses designed to draw attention to one's direct material and embodied relationships to digital objects and systems. These moments work to re-orient relationship to digital systems and allow subject to explore new positionalities and ways of being in relation to the digital.

### **Explanation of Dissertation Format and Overview of Key Contributions**

This dissertation is composed of three stand-alone, single-authored articles based on my empirical fieldwork in Barcelona. The articles make three separate contributions to ongoing debates over the politics of the smart city, the role of digital technologies in the production of urban space, and the differential production of digital subjectivities.

The first article (Appendix A) is titled "Contesting Digital Futures: Urban Politics, Alternative Economies, and the Movement for Technological Sovereignty in Barcelona." This article is published in *Antipode* (2019). The article intervenes in theoretical debates over the politics of "smart city" development through an engagement with literature on urban social movements and alternative economies. This article gives the broadest overview of the TS movement and the diversity of initiatives and influences that constitute it. In it, I explore the concept of "technological sovereignty" employed by activists in Barcelona, describing its basis in experiments with alternative arrangements of work and property, an ethics of care, and an engagement with municipal institutions. I argue for the need to think beyond binaries of techno-optimism and techno-pessimism to imagine a multiplicity of possible futures emergent in ongoing processes of urban and technological change.

The second article (Appendix B) is titled “Re-Claiming the Digitally-Mediated City: Spatial Knowledge, Digital Infrastructure, and the Work of Amateurs.” This article is currently in review at *Environment and Planning C: Politics and Space*. The paper contributes to debates on the evolving role of software code and networked infrastructures in producing urban space. Scholars have examined how digital infrastructures regulate flows of information, energy, people, and goods in and across cities, operating in the background of urban life. Such developments create concerns about privacy, transparency, and the narrowing of urban democracy. I employ Stiegler’s notion of “proletarianization” as the loss of knowledge, to argue that the automatic production of space as it is normally described constitutes the proletarianization of space, or the centralization of spatial knowledge. The paper describes the practices of Guifinet, groups that build and maintain their own broadband internet infrastructure, focusing on the multiple forms of knowledge production and circulation on which these projects are based. I present Guifinet as an example of amateur practices of de-proletarianization, as urban residents re-claim critical forms of spatial knowledge about the city. In doing so, I demonstrate the possibilities for digital infrastructures to create new spaces for democratic power based on alternative logics of techno-social organization.

A third article (Appendix C) is titled “Unruly Digital Subjects and the Politics of Technological Expertise.” This article is in preparation for submission to *Transactions of the Institute of British Geographers*. The paper contributes to emergent debates in feminist and queer digital geographies on the production of digital subjectivities. Much of this literature explores how conceptions of identity and belonging are shaped through digital technologies—such as when algorithmic logics create new processes of inclusion/exclusion, re-orienting social practices in the process. Yet, this literature generally approaches digital technology as a mediator of subjective experience, rather than asking how subjects understand and experience their relationship to

evolving digital systems within hierarchies of technological agency and expertise. I bring this literature together with earlier work in feminist geographies and related disciplines on the gendering and racialization of technology to consider how material discursive processes through which digital subjectivities are emergently produced and differentiated. In the case of Barcelona, I describe the ways the actions of TS activists challenge the discursive separation of technology from the rest of social life, and the way an inclusive digital politics queers established hierarchies and subject positions in relation to technological agency.

### **Conclusions and Opportunities for Future Research**

Geographers have long explored questions around the use and effects of digital technology—particularly in critical and feminist approaches to GIS (Elwood 2006; Kwan 2007); but only in the past few years has “digital geographies” emerged as an organizing concept, bringing together scholars from across the discipline around related questions of digital development (Ash et al 2019). This dissertation, taken as a whole, makes a series of significant contributions to this emerging subfield and aims to push it in new directions. These contributions can be summarized in three main points:

- 1) This dissertation responds to and builds on critiques that digital geographic scholarship has undertheorized the role of the *posthuman* at the expense of accounting for the agency of technical objects and systems (Rose 2017). It does so by adopting a theoretical orientation inspired by Barad (2007) and Stiegler (1998) that recognizes the inextricable entanglement of human and technical modes of being, and operationalizing that orientation through ethnographic research with community-based technology collectives. This approach puts the emphasis back on the role of

always differentiated and differentiating *posthumans* and their modes of being with technological objects and systems.

- 2) Across the three appendices, this dissertation traces the transversal role of emerging digital technologies in everyday life—from the broad, extensive relations of the economy, to grounded practices of spatial production and knowledge sharing, to the intimate relations that shape conceptions of the self. Economies, urban space, and the self are all always in the process of becoming and the proliferation of new technologies in everyday life inevitably reshapes all of these.
- 3) Finally, the dissertation offers one of very few accounts of what an active politics of contesting the hegemonic processes of digital innovation might look like in practice. The three appendices attached offer different perspectives on the kinds of political practices capable of imagining and building alternatives to techno-capitalism's monopolized vision of the future. I show how challenging the hegemony of techno-capitalism requires experimentation with alternative economic practices and arrangements, new forms of knowledge production and sharing, as well as a radical disruption of de-politicized notions of digital citizenship and constructed hierarchies of technological expertise. Alternative, more just digital futures will not be brought about by simply expanding access to technology or including more people in existing technological practices, but by a radical re-thinking of what digital technologies are or might be, and how individuals-in-collectives are able to relate to them and re-make them.

Reflecting on these contributions, I highlight at least three main directions for future research on the entangled processes of urban and technological change based on my experience and findings in this project.

### *Grassroots Technology Movements*

While this dissertation highlights the work of activists in Barcelona, the TS movement is not the only example of critical, community-based technological development around the world. Multiple technology collectives in cities across Latin America are building and maintaining their own “feminist servers” and autonomous infrastructures, and founding critical programming cooperatives based on post-capitalist ethics (Derechos Digitales 2017). Other collectives are operating in cities around the world—like the Collective for Liberation, Ecology, and Technology (CoLET) in New York or the Tactical Technology Collective in Berlin.

Despite their broad diversity, these movements share important similarities. While extensively networked, and drawing on a global commons of open-source knowledge, these groups often work locally to address needs in the communities in which they are situated. These groups challenge taken-for-granted aspects of techno-capitalist development models—the ideology of “innovation” (Russell and Vinsel 2016), programmed obsolescence, and the ecological impacts of digital infrastructures and systems. There is ample opportunity and need for further research on these kinds of grassroots movements, their motivations, values, and practices. In particular, scholars might look to the technological practices of marginalized communities and communities in the Global South, exploring the relationships between experiences of urban informality, for instance, and forms of grassroots technological agency.

### *Digital Subjectivity*

While recent scholarship in digital geographies have begun to explore the ways digital technologies increasingly shape processes of subjectification and emergent subjectivities, there

remain many questions for future inquiry. In particular, as I argue here, scholars have engaged little with the way digital technology gets discursively tied to whiteness, masculinity, and cis-heteronormativity, and as such de-politicized and posited as universal. This is likely due to a tendency in digital geographies scholarship to engage theoretical frameworks around “new materialisms” and posthumanism and the consequent move away from theories of discourse. Yet, as I hope to show in Appendix C, these theoretical orientations are completely compatible, and indeed only make sense in conjunction.

Beyond this dissertation, there is a need to explore discourses around technology, processes of technological change, and the distribution of technological agency, both to understand how they shape common conceptions of technology and to understand how they are continually reproduced through material discursive practices involving an array of human and nonhuman actors. This work could include further engagements with: the ways technology and technological innovation is represented in cultural productions and popular media, prevailing practices in technological education across cultural and spatial contexts (Holloway et al 2000; Emejulu and McGregor 2019), and the evolving organization of digital work (Richardson 2018), among other topics.

### *Silicon Valley, the Tech Industry, and the Future*

There is an urgent need for critical empirical research on the practices of elite actors in the technology industry and the visions of the future they aim to produce. As discussed above, powerful actors from Silicon Valley and the broader technology industry are not just involved in developing new technologies, but also in proposing radical changes to existing social, political, economic orders (Lynch 2017). Scholars might interrogate the way the logics of innovation and “disruption”—exemplified in Mark Zuckerberg’s famous motto of “move fast and break things”—

has moved beyond the technology industry itself inspiring entrepreneurial activities across sectors that move at a pace far beyond existing states' abilities to regulate them. Critical scholars cannot afford to simply react to these development, but need to be able to follow them in real-time and challenge their monopolistic claims to the future.

In a similar vein, critical scholars need to follow and engage ongoing processes of research and development in the technology sector—particularly around artificial intelligence and machine learning, robotics and autonomous systems. Scholars have examined the evolution and use of such autonomous systems in war zones (Shaw 2017), along with the emerging regimes algorithmic management at borders and in cities (Amoore and Raley 2017; Leszczynski 2018). Yet, many questions remain and the pace of technological change in the current conjuncture demands more. Geographers are uniquely positioned to help build a broader, public, and cross-disciplinary discussion about the current direction of technological research and development, its ethics and politics, and impacts on everyday life. In short, we need a critical geography of the technology industry capable of engaging in real time with the entanglement of political, economic, social, cultural, and technological activities in and across space.



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## APPENDIX A

### **Contesting Digital Futures: Urban Politics, Alternative Economies, and the Movement for Technological Sovereignty in Barcelona**

#### **Abstract**

Scholars have offered important critiques of the socio-spatial processes of contemporary technological development, including the rise of “smart city” urban development models. While these critiques have been essential for understanding contemporary forms of techno-capitalism and its reach into new areas, this paper calls for a consideration of *alternative* modes of digital development in urban life beyond the logics of securitization and capital accumulation. In particular, I examine the critical discourses and experimental practices of a grassroots movement focused on claiming “technological sovereignty” (TS) in Barcelona. The TS movement is a broad, de-centralized network of cooperatives, associations, and community initiatives experimenting with alternative practices of locally-rooted, open-source digital development. These groups explore democratic and cooperative practices of work, property, production, and consumption in relation to digital technology, based around an ethics of care and a commitment to working through and within local communities. In examining the values, beliefs, and practices of the TS movement, I bring ongoing discussions around digitalization and the “smart city” into critical conversation with the extensive literature on prefigurative urban politics and postcapitalist economies.

**Keywords:** technology, sovereignty, digital, postcapitalism, urban politics



## 1. Introduction

In the past several years, geography has seen the rapid growth of interest in questions around digital technologies, including robots (Del Casino 2016), big data (Kitchin 2014), algorithms (Crampton 2016; Amoore 2018), social networks (Shelton, Poorthuis, and Zook 2015), and the new spatial forms to which they give rise—the smart city (Kitchin 2015), the smart border (Amoore 2006), and “code/space” (Kitchin and Dodge 2011). Geographers have been well positioned to offer insightful and necessary critiques of the ways these technologies reshape dominant epistemologies, relationships of power, and spatial practices, while highlighting the agentic capacities of technological objects and systems (Ash, Kitchin, and Leszczynski 2018).

Yet, this growing body of scholarship has given less attention to the question of alternatives—alternative digital economies, alternative spatial forms, alternative understandings of what technology *is* or *might be*. In much of this scholarship, emerging technologies are developed and controlled by state, military, and/or corporate actors; and indeed, this is the hegemonic model of technological development today—driven by the sometimes convergent and sometimes conflicting desires of the State for new forms of security, surveillance, and control, and by private firms’ drive for profit.

If, as much of the digital geographies literature has argued, we need to recognize emerging technologies as inherently political and entangled in power-laden socio-technical assemblages, then what might an aspirational postcapitalist politics (Gibson-Graham 2006) of digital technology look like? What kinds of radical political possibilities arise from the ongoing co-evolution of technics and humanity (Stiegler 2013)? If urban algorithmic governance is constituted through “material-discursive projects of ‘future-ing’” (Leszczynski 2016, 1691) based on logics of

securitization, what alternative projects of ‘future-ing’ exist or might exist? Based on what logics and values?

This paper explores the question of alternative modes of digital development in urban life. In particular, I explore the discourses and practices of a grassroots movement in Barcelona organized around the notion of “technological sovereignty” and devoted to claiming radical democratic control over processes of technological development. The movement experiments with alternative economic practices and forms of organization for digital production and consumption. These practices are driven by an ethics of care and deeply territorialized in the city and local community—seeing technological sovereignty as a way to “rethink the model of the city” (*SobTec 2016* website, accessed 17 December 2018).

In exploring the values, beliefs, and practices of this movement, I bring geographic discussions on processes of digitalization and the “smart city” into critical conversation with work on urban political movements and alternative economies. I build on previous work on grassroots urban movements that aim to radically remake the socio-political and economic relations of the city by enacting alternative practices—a kind of prefigurative politics of grassroots city-making (Davidson and Ivseson 2015; Wanzer-Serrano 2015; Gray 2017); and I highlight the importance of exploring the possibilities for alternative economic arrangements and practices based on post-capitalist logics (Gibson-Graham 2006; Diprose 2017; Zanoni et al 2017; Healy et al 2018). Following previous geographic research on such “diverse economies,” I aim to bring “marginalized, hidden and alternative economic activities to light in order to make them more real and more credible as objects of policy and activism” (Gibson-Graham 2008).

The goal of this paper is to move from a standpoint of critique to a position of openness toward the possibilities for alternative, counter-hegemonic (Laclau and Mouffe 1985) modes of

digital development in (re)producing urban life. Existing initiatives of activist and hacker collectives around the world offer glimpses of alternatives. The Free and Open Source Software (F/OSS) movement has long struggled against the privatization of technological knowledge, working to build a digital software commons through alternative regimes of labor and property (Söderberg 2015), while “hacktivist” movements work to disrupt the functions of state and capitalist technological apparatuses (Coleman 2013). A report by the group *Derechos Digitales* (2017) documents projects around Latin America devoted to building common digital infrastructures, free software, and feminist technology often through social movements and cooperative enterprises; while two dossiers from the Calafou Postcapitalist Eco-Industrial District near Barcelona offer examples from around the world of self-managed servers, biohacking labs, and open-source 3D printing (Hache 2014; Hache 2017).

Since roughly 2014, a loose network of individuals and collectives has emerged in Barcelona organized around the notion of “technological sovereignty.” This community is focused on distinct projects and initiatives building community-based technological systems and services with social objectives. The movement is particularly interesting for the wide variety of projects with strong territorial ties to the city—from community-managed broadband infrastructure, autonomous servers, and an open source Internet of Things network, to free software cooperatives and spaces for public education and collective reflection. Each year since 2016 a group of activists has organized the “Technological Sovereignty Congress”—or *SobTec*—while global justice NGO, SETEM-Catalunya, has organized the Mobile Social Congress featuring “technological sovereignty” as a primary theme. Increasingly the language of “technological sovereignty” can be found in the manifestos and websites of many local cooperatives and associations, and is frequently evoked in public events, debates, training courses, and workshops.

Below, I offer a brief discussion of methods and then introduce the TS movement, situating it in the context of contemporary Barcelona. In the following section, I review existing literature on the “smart city” and processes of digital innovation in cities, highlighting the lack of discussion around alternative modes of development. I then place this literature in relation to scholarship on prefigurative urban politics and alternative economies. The remainder of the paper is divided into two main sections. Section 3 examines TS actors’ critiques of the hegemonic model of technological development and their theorization of “technological sovereignty” as an alternative. Section 4 explores the practices and strategies for pursuing TS, focusing on the movement’s experimentation with alternative models of economic organization, practices of care, its territorialization in Barcelona and relationship to the municipal government.

### *1.1 Methods*

This paper is based on over a year of fieldwork carried out in Barcelona between 2016 and 2018. During this time, I conducted participant observation with several TS-related initiatives and attended public events related to technology politics in the city, including the Smart City Expo, Mobile Week Barcelona, the Mobile Social Forum, and the Technological Sovereignty Congress (SobTec). I participated in several digital forums focused around TS on platforms like Telegram, Signal, and Riot. I also conducted more than 20 interviews with individuals involved in TS initiatives and collected and analyzed pamphlets, promotional materials, flyers, and other documents related to TS. Most interviews were conducted in Catalan, while others were conducted in Spanish. Events and meetings were typically conducted in Catalan and Spanish, as well as occasionally English. I am fluent in all three languages and all translations throughout the paper are my own.

### *1.2 Technological Sovereignty in Barcelona*

The movement for technological sovereignty represents a confluence of multiple historical and contemporary influences in Barcelona. The movement partially emerges as a reaction to the intensification of capitalist technological development models in the city. Beginning in 2011, then-Mayor Xavier Trias sought to turn Barcelona into a premier “smart city,” partnering with multinational firms like IBM and Cisco to experiment with “smart” technologies for urban management (March and Ribera-Fumaz 2016). Barcelona also became the host of the annual Smart City World Expo and the Mobile World Congress—holding the title of “Mobile World Capital.”

Yet, the city is also home to an extensive activist community that has mobilized in opposition to corporate globalization, neoliberalism, and austerity—including the 15M protests and occupations of 2011 (Perugorria and Tejerina 2013; Antentas 2013) and the counter-globalization movement of the late 1990’s and early 2000’s (Juris 2010). The particular manifestations of these movements in Barcelona are rooted historically in the city’s anarchist movements of the late 19th and early 20th century (Ealham 2010). Barcelona has also been an active hub of activity in the Free Knowledge movement (Fuster Morell 2012; Fuster Morell et al 2015) and hacker movements, and boasts an extensive solidarity economy sector rooted in historical traditions of cooperativism in Catalonia (Miro and Fernandez 2016). Finally, the growth and evolution of the movement for Catalan independence from Spain has increasingly prompted critical debates over the nature of democracy and sovereignty and the failures and abuses of current forms of state power and capitalist development (Benitez Romero et al 2017).

The TS community is composed of a diverse range of initiatives, from those focused on infrastructure, hardware, and software development, to the provision of technical services and the

promotion of reuse and recycling (see Figure 1). For instance, Guifinet is a decentralized network of community associations and volunteers that build and maintain their own broadband internet infrastructure, managing their own servers, laying fiber optic cables, and relaying signals through a series of antennas and routers. The network is the largest such “community wireless network” in the world, with over 35,000 active nodes. The Things Network (TTN) builds a community-managed Internet of Things sensor network through the Guifinet infrastructure.

Small worker cooperatives—including Jamgo, Colectic, Adab1ts, Dabne, Coopdevs, and Lliuretic—develop open-source software and technical services for local businesses, often in the broader Solidarity Economy Network. Meanwhile, eReuse and Alencop promote the responsible reuse and recycling of digital devices. Other cooperatives in the housing, mobility, food, and service sectors experiment with forms of “platform cooperativism” (Scholz 2014)—using open source technologies to innovate and coordinate broader cooperative economies. Cooperation across these groups is common, pooling resources, skills, and knowledge in pursuit of shared projects. Such is the case of the CommonsCloud Alliance in which multiple groups coordinated through the cooperative FemProcomuns collaborate to create a commonly-managed cloud infrastructure. There are also multiple initiatives focused on community education and training, and creating spaces for collective reflection and theorization, as discussed above.

**Table 1: TS Initiatives**

<b>Area of Action</b>	<b>Groups, Projects, and Initiatives</b>
Infrastructure and Hardware	Guifinet et al, The Things Network, CommonCloud, Equipaments Lliures, Mar de Bits, Ateneus de Fabricacio
Software and Services	Coopdevs, Jamgo, Colectic, Adab1ts, Dabne, LliureTIC, Barcelona Free Software
Reuse and Recycling	eReuse.org/reutilitza.cat, Alencop

Cross-Sector Economic Activity	Katuma, SomMobilitat, Riders por Derechos, Voki Voki, SomConexio, Pangea, ITC Commission of XES
Education and Training	Colectic, ExO, Ateneus de Fabricacio, La Comunicadora, Alencoop, Smart Citizen/DECODE, Smart Barris, Universitat Lliure de Sants, Dimmons (Digital Commons Research Group, Open University of Barcelona)
Reflection and Theorization	SobTec, Mobile Social Congress, Calafou, La Teixadora, Dimmons

## 2. Digital Geographies and Alternative Futures

I situate the following discussion of the TS movement in relation to recent geographic scholarship on processes of technological change and the emergence of new digital technologies in urban life. I argue that the TS movement demonstrates the possibilities for alternative modes of digital development—a topic that has been thus far neglected in most digital geographies literature focused on critiques of the dominant model. To think through the possibilities for alternatives, I position the TS movement in relation to two existing areas of geographic scholarship: the extensive literatures on grassroots, prefigurative urban politics and alternative economies.

### 2.1 Digital Geographies and the “Smart City”

The past several years have seen the rapid expansion of geographic scholarship focused on the proliferation of digital technologies and their widespread impacts across economies, governance, social life, and geographic inquiry itself (Ash, Kitchin, and Leszczynski 2018). Much of the emergent scholarship in digital geographies has focused on the “smart city”—the increased use of complex assemblages of digital infrastructures, data, and algorithms in the governance of cities (Kitchin 2015). Scholars have offered careful explanations of the operations and forms of agency exercised by increasingly connected, “smart” infrastructures and devices, and their roles

in producing urban space (Dodge et al 2009) and delivering vital services (Goldsmith and Crawford 2014; Albino et al 2015).

Within this literature there have been continual calls to politicize the smart city. Geographers have offered insightful critiques the smart city as a techno-capitalist model of entrepreneurial urban governance (Wiig 2015; Luque-Ayala and Marvin 2015), and as a new form of securitization, surveillance and control (Vanolo 2014; Klauer et al 2014; Leszczynski; Shaw 2016). Others have examined how digital media and devices “augment” the experience of urban spaces, mediating relationships of power (Graham et al 2013). While scholars explore the possibilities for “citizen participation” in smart city initiatives, they have often found very limited and constrained forms of participation in practice (Tenney and Sieber 2016; Cardullo and Kitchin 2018), highlighting the ways smart city programs turn political issues of urban governance into problems with “technical” solutions. Citizen participation becomes constrained by techno-solutionist logics. Despite these critiques, there have been fewer attempts to consider what alternative, more democratic, and socially-just alternatives might look like.

In her critique of this literature, Rose (2017) has argued that most discussions on the “digitally-mediated city” have failed to fully theorize *posthuman* agency, focusing instead on the agential capabilities of digital devices and infrastructures. She calls on geographers to “reconfigure their understanding of digitally mediated cities and acknowledge both the reinventiveness and the diversity of urban posthuman agency” (Rose 2017: 789). By highlighting the possibilities for urban residents to enact different forms of “spatial and temporal organization of practices and meanings” (Rose 2017: 787), Rose gestures toward to the possibilities for exploring alternative techno-social relations in the city. More explicitly, Elwood and Leszczynski (2018: 640) have recently called for “feminist digital geographies” to explore the “possibilities of a liberatory digital politics for re-



making our technologies and ourselves as digital subjects.” Along this vein, I argue that the TS movement in Barcelona offers an example of how urban residents can exercise political agency through forms of creative experimentation with digital technologies—performing alternative economic practices and enacting forms of radical democracy against the “post-political” turn in urban governance.

## *2.2 Prefigurative Urban Politics and Alternative Economies*

The de-politicization of key aspects of urban life through the implementation of “smart city” models is just the latest in a long succession of “post-political” urban policy agendas focused on making cities “competitive, global, secure, and sustainable” (Davidson and Iveson 2015: 544). MacLeod (2011), Swyngedouw (2011), and others have examined how urban policymaking has become increasingly shaped by the production and policing of consensus as opposed to the “dissensus” or agonism seen by many as key to robust urban democracy (Staeheli 2010). This constructed consensus as to what constitutes good urban governance allows for the rise of technocracy—as experts are brought in to implement global “best practices” and the space of democratic debate is continually constrained.

In opposition to such “post-political” logics, several scholars have recently explored the possibilities for enacting radical alternatives—reclaiming the city as the space of democratic politics (Iveson 2014; Davidson and Iveson 2015). While some of this literature has examined large-scale mobilizations reclaiming urban space for protest (Staeheli 2013), others have focused on examples of *prefigurative* urban politics—enacting the social, political, and economic changes the activists wish to see, beyond petitioning the state for rights (Ince 2012). In an historical case from the 1970’s, Gray (2017) examines the autonomous Marxist “Take over the City” movements in Italy, presenting their direct “territorial autogestion” as a more radical alternative to rights-based

discourses. In a similar way, Wanzer-Serrano (2015) examines the case of the Young Lords in Spanish Harlem in the late 1960's and early 1970's, a liberation movement demanding community control over local institutions and land. In a more contemporary example, Bunce (2016) describes the East London Community Land Trust as a political strategy for challenging capitalist development models and creating new "urban commons." This literature stresses the material and spatial relations of the city as key to enacting such alternative futures—reclaiming radical democratic control over the common infrastructures on which urban residents depend and the common spaces in which they live. In many cities around the world, these common infrastructures and spaces are increasingly controlled, augmented, or mediated by digital technologies.

Such prefigurative politics have also been at the heart of geographic literature on various kinds of "community economies" (Roelvink et al 2015). This work explores the possibilities for creating alternative economic practices beyond or in opposition to the hegemonic capitalist order (Bauwens 2005; Gibson-Graham 2006; Benkler 2006; Stiegler 2014). Gibson-Graham (2006) develop a vocabulary of economic diversity, recognizing the multiplicity of existing and possible arrangements for organizing economic activity. Activists around the world have theorized and experimented with alternative "solidarity economy" initiatives (Allard and Davidson 2008), while scholars across disciplines have examined processes of creating new "commons" (Healy et al 2018). All of this literature considers how relationships of production, consumption, labor/work, and property are reconfigured through experimentation with alternative economic models guided by notions of autonomy, solidarity, equality, and care (Diprose 2017). While the "community economies" literature in geography has engaged little with the possibilities offered by digital technologies, others have examined the alternative models of production and consumption in the free software movement (Söderberg 2015) and the broader possibilities for commons-based modes

of peer production made possible through the internet (Bauwens 2005; Benkler and Nissenbaum 2006).

Like the movements for radical urban democracy discussed above, diverse economy movements contest hegemonic visions of the future and actively work to build alternatives through grassroots forms of organization and experimentation. I draw on both bodies of literature in approaching the TS movement in Barcelona. I describe the movement as a network of prefigurative projects collectively theorizing and experimenting with alternative political economic models of digital production and consumption to re-produce and re-make urban life.

### **3. From Critique to Alternative Digital Futures**

This section describes TS activists' broad critiques of the hegemonic model of technological development, and then examines the production of a discourse around "technological sovereignty" as a way of collectively imagining alternative digital futures.

#### *3.1 Critiquing the Techno-Capitalist Order*

The TS movement is informed by a well-developed critique of techno-capitalism based on the lived experiences and observations of Barcelona-based activists. The critiques offered by TS activists are not directed at any particular digital technology or set of technologies, but rather at the political economic arrangements and techno-social relations within which such technologies are produced, proliferated, and utilized in the contemporary conjuncture. Significantly, this approach to critique leaves open possibilities for imagining and experimenting with alternatives.

TS activists' critiques can be organized into four related themes: the loss of control over technological systems, the exploitative and opaque business models of contemporary techno-

capitalism, the depoliticization and de-socialization of technological knowledge, the uneven geographies of technological development, and the state's facilitation of increased surveillance. All of these critiques are addressed within the broader TS discourse as demonstrated by activist Margarita Padilla's (2017) explanation of the driving questions behind the movement: "the question we wish to discuss is who has the power to make decisions about them [technologies], about their development, about their use, about access and about distribution, about supply and consumption, about the prestige they have and their power to fascinate..."

Many TS activists argue that as digital systems become more complex and infiltrate further into all aspects of life, the average person has less knowledge of them and thus less ability to exert control or make informed decisions about their relationship to them. As TS activist Chris (interview, 3 May 2018) explains: "Technology is continually more present, and we are continually more dependent on it. You take a cell phone and you can say, 'I don't know half of the things it is doing, and in two years when I have the next one, I'll know even less. And it is going to have a greater impact on my life.' And it will get to the point where you have something that you don't recognize, and it is yourself." This perspective is common across TS activists, who highlight broad concerns about losing control over key aspects of everyday life to techno-capitalist firms with limited accountability.

TS activists take specific issue with the opaque business models of contemporary techno-capitalism based on the exploitation of personal data and the monitoring, profiling, and manipulation of digitally-mediated activities. As one activist explicates: "People use Google and Facebook and Twitter, and it is all free. But they don't realize that if something is free, you are probably the product—your data, your information, and your privacy" (interview, 16 February 2018). The vast majority of technology users lack basic knowledge about what data are collected,

how they are used, by whom, and toward what ends, as many of the algorithms that process such data are hidden from view, subject to intellectual property protections.

Such exploitative practices are also obscured by the discursive privileging and de-politicization of technological knowledge. TS activists critique the division of knowledge into separate social and technological spheres, echoing common calls in scholarly analysis to recognize technologies as always situated in socio-technical milieus (Kitchin and Perng, 2016). For instance, Nuria explains that “technologies are ways of fulfilling some need or accomplishing something you want to do. They can’t be separated somehow from the rest of life” (interview, 21 March 2018). Margarita Padilla goes further situating technology at the heart of human life: “[t]echnology, from fire or flint to the monumental constructions that we use everywhere, almost without noticing, is the body of culture. Without technology, there would be no culture” (Hache 2017, 10). Recognizing this, TS activists reject the discursive framing of technical knowledge as a specialized and privileged field of knowledge to which only a select few have access—generally wealthy, white, educated men. They critique how this artificial division of knowledge allows for the proliferation of a singular narrative about what technology *is* and projects the future of technology as a linear progression of development divorced from broader social systems.

This erasure of the social and political nature of technology is also an erasure of spatial differences. TS activists highlight the uneven spatial distribution of technological access, knowledge, and authority, namely the concentration of authority over technological development in the United States, and Silicon Valley in particular. As the world’s largest technology firms are located in the United States (and increasingly China), citizens in Barcelona have limited ability to interrogate or challenge the practices of companies that control personal data and maintain the infrastructures on which daily lives increasingly depend. The loss of basic technical knowledge

also contributes to the loss of broader spatial and political knowledges, as the material and spatial nature of technological systems are made invisible, fading into what Thrift (2004) calls the “technological unconscious.” Irene reflects on this hidden geography: “You hear about the ‘cloud’ and people think it is literally up in the air. You send an email and people think it just magically arrives on someone else’s computer. You don’t see that these services work through modems and servers that are located in particular places” (interview, 16 February 2018).

The TS community also critiques the ways corporate technology is increasingly adopted by states and municipalities. They point to Barcelona’s own experimentation with “smart city” and related programs as projects of surveillance and control that work to depoliticize vital debates over urban development processes while privatizing urban data and vital infrastructure. For instance, activists have fought against the implementation of T-Mobilitat—a “smartcard” ticketing system for public transportation—highlighting concerns about data privacy, the lack of transparency, and the privatization of public services. These critiques have been widely echoed by critical geographical scholarship on smart city projects.

### *3.2 Theorizing Technological Sovereignty*

Since around 2014, the notion of “technological sovereignty” has gained influence in Barcelona as a way of imagining and building alternatives to the hegemonic model of technological development. Since then TS activists have collectively theorized what technological sovereignty might look like in practice and how it might be pursued. Like the prefigurative politics of the movements discussed above, this theorization is the product of active experimentation and reflection. The two dossiers published by the Calafou Post-Capitalist Eco-Industrial District develop a theory of “technological sovereignty” based on the experiences of a range of actually-

existing open-source technology projects from around the world. The community conference SobTec creates a space for local initiatives to exchange ideas and reflect on their own practices and their politics. Other events like the Solidarity Economy Fair of Catalonia and the Mobile Social Congress create spaces for networking and exchange of ideas across open-source, community-based technology projects, out of which “technological sovereignty” emerges as a common organizing concept. As the working product of ongoing processes of collective experimentation and reflection, “technological sovereignty” is a concept with multiple meanings that gets taken up and enrolled in a variety of projects in different ways. Here, I offer a rough outline of some of the common ways TS is understood in Barcelona.

For many TS activists, the notion of “sovereignty” has roots in movements for food sovereignty, rather than direct claims on state power. In the introduction to the 2014 *Soberanía Tecnológica* dossier, Alex Hache cites the conception of food sovereignty as the basis for theorizing technological sovereignty, explaining that the idea was first coined by Via Campesina in 1996 to combat discourses of food *security*. Logics of food security worked to diminish community control over vital food systems, through a rationalization and de-socialization of food production and close partnerships between corporate food interests and state apparatuses. Food production and distribution became a de-politicized ‘technical’ question. This juxtaposition of sovereignty to security is key, as many scholars have highlighted the similar logics of securitization on which contemporary processes of digitalization are based (Leszczynski, 2016).

The TS movement sits in relation to other movements in Barcelona focused on reclaiming energy, food, residential, cultural, and health “sovereignities.” The concept of “sovereignities” has become an increasingly powerful organizing concept for progressive and radical politics in Barcelona and beyond in recent years. The collective authors of *Sobiranes* [Sovereignities]

(Benitez Romero 2017)—affiliated with the left-wing, pro-independence political platform *Candidatura d’Unitat Popular* (CUP)—present the fight for “sovereignities” as processes of creating direct democratic control over the vital systems and infrastructures of everyday life. Activists argue that these movements are fundamentally about “putting social reproduction under democratic control” (Benitez Romero et al 2017, 49) and promote them as a “proposal against capitalism” (ibid). In this sense, the notion of “sovereignities” articulates an alternative political economic logic and strategy in a similar way to the various alternative economy movements discussed above. It calls for fighting ongoing processes of neoliberalization not just by demanding changes to state policy, but by building new structures, relationships, and arrangements for meeting the population’s needs.

Thus, when applied to technology, the idea of sovereignty is about building alternative modes of developing, producing, and consuming technologies that are transparent, democratic, and work toward the overall goal of meeting community needs and re-producing collective life. Additionally, as digital technologies become increasingly important to the management of other vital systems—from food systems and health care, to energy and mobility—TS becomes essential to re-claiming broader forms of radical democratic control.

While existing practices of “open-source” production are important, they do not go far enough. Several authors have highlighted the ambiguous politics of the open-source movement, and recognize the various ways open-source knowledge gets enclosed, sometimes feeding further capital accumulation. Further, the open-source community is rather limited, consisting of generally geographically dispersed individuals and groups without strong territorial ties. TS recognizes the importance of open-source models, while seeking ways to socialize and territorialize them— involving a more diverse and inclusive community and using them to transform broader social,



political, and economic processes. As one activist commented in 2016: “We cannot rely only on five ‘nerds’ if we truly want to transform our relationship to technology and remake our city” (fieldnotes, 15 August 2016). In challenging the privileging of “technical” knowledge above social knowledges, TS activists also see questions of gender equity and broader questions of social equality as key to creating more inclusive, democratic digital systems.

#### **4. Enacting Alternative Modes of Digital Development**

The remainder of this paper examines the ways Barcelona-based actors work to create an alternative model of digital development in practice. I explore TS initiatives’ alternative forms of economic organization and then examine how these alternative models rely on everyday practices of care. The following section describes how these projects constitute a particularly urban, place-based politics, presenting the city as a key site from which to enact such alternatives. The final section reflects on the role of the progressive municipal government in promoting TS.

##### *4.1 Alternative Digital Economies*

TS initiatives experiment with alternative economic models, including the collaborative model of open-source software production, as well as commons and cooperative-based arrangements. These alternative models challenge traditional notions of labor and property, and divisions between producers and consumers, while working to democratize technological knowledges.

Technology workers’ cooperatives, like Colectic and Jamgo, offer alternative models for organizing work in the technology sector. While Stiegler (2014) argues that in contemporary “cognitive capitalism” so-called “knowledge workers” are increasingly enrolled in complex organizational forms that deprive them of knowledge and agency, these cooperatives implement

horizontal forms of decision-making for organizing work processes with workers exercising direct control over their own knowledge. As a member of one cooperative explains: “We meet in an assembly each Friday to organize the work and make decisions. It can be very complicated and we do not always agree, but in the end, we come to collective decisions” (interview, 16 March 2018). These cooperatives also make collective decisions about the use or investment of the surplus generated by their activities. In the case of Colectic, the cooperative offers digital services on the local market, the income from which goes to support the cooperatives’ youth social work programs—reinvesting in the capacities of the local community.

While in cooperatives such work constitutes a form of employment (cooperative self-employment), in commons-based projects like Guifinet or TTN, “work” is a more diffuse concept. Such projects rely on the contributions of a wide array of local actors, from the neighbors who install and maintain their own antennas, sensors, or other equipment, to those who coordinate such projects in their neighborhoods or experiment with new equipment to improve the common infrastructure. This work is typically not remunerated and is instead inspired by a mixture of personal enjoyment, political conviction, and care for the broader community.

The economic practices also challenge traditional notions of property. Alternative notions of property are clear in the free software and free knowledge movements, within which code, designs, and other forms of “intellectual property” are shared via the internet, building a digital knowledge commons. This model is harnessed by actors in the TS movement, as when the worker cooperative Coopdevs uses code from the Open Food Network to develop the application for Katuma, a local agricultural consumption cooperative. As Sergi from Coopdevs explains: “we developed the application from the Open Food Network, adjusting it for our needs, but we don’t own it. We develop it *with* them, and the cooperative [Katuma] can do what they want with it.

They can replace us with other developers and keep using the app. And others can take and use and change the app however they want” (interview, 29 January 2018).

Notions of property are further challenged by the practices of Guifinet and eReuse. While in free software development the “property” in question is intellectual property, and thus easily shared via the internet, in these projects property consists largely of material objects and infrastructure. In the case of eReuse, electronic devices are managed through “community licenses” in which individuals exercise a right to *use* devices, but are required to adhere to particular principles regarding the devices’ reuse and eventual disposal. Such an arrangement reconsiders property in its original legal sense, as a bundle of rights over a particular object—rights that may be selectively restricted or contingent on particular actions.

In Guifinet, much of the infrastructure that makes up the network is private property, but is offered voluntarily to the common infrastructure, while other pieces of equipment may be owned collectively by a local association or the Guifi Foundation. The networked nature of the infrastructure means that any individual piece of equipment is reliant on the broader whole. While I own my own antenna, router, and cables, they only function if connected to the broader network. This co-dependence of the material infrastructures necessarily obscures notions of property. While anyone is welcome to withdraw their individually-owned piece of equipment, that equipment loses its use-value outside of the broader network.

These models also blur divisions between producers and consumers. For instance, in GuifiAmunt, the local Guifi association for the neighborhoods of Horta and El Carmel, members pay five euros per month to maintain and update the shared infrastructure. Not every member actively participates in the maintenance of the infrastructure beyond their own home—either for lack of time, desire, or technical knowledge—but there are no distinctions among the association

members. All decisions are made by consensus at monthly meetings. While some members may have more technical knowledge, or be more involved in the work of the project, they collectively decide on updates or changes to the network. In the case of Katuma, the local food cooperative is composed of agricultural producers, app developers, and local consumers with decisions made collectively among them. Such organizational forms recognize the co-dependent relationship between production and consumption and build democratic practices for managing that relationship and the various knowledges on which it is based.

Yet, these alternative economic practices also face challenges, including limited funding and their reliance on volunteer or part-time labor. As many activists point out, the business models of companies like Google and Facebook offer high-quality services for free, making profit from the exploitation of personal data. It is difficult to convince individuals, small companies, and even cooperatives to spend more to invest in open-source, community-based technologies, as the true cost of labor, materials, and maintenance of such systems are made invisible in the dominant model. Activists admit that the future expansion of technological sovereignty depends on exploring new practices and alliances, and building greater awareness of the abuses of the hegemonic model within the local community.

#### *4.2 Practices of Care*

In contrast to the logics of capital accumulation and securitization on which contemporary models of “governing through code” (Klauser et al 2014) rely, the TS initiatives are driven by an ethics of care. That is, the initiatives are not purely “economic” but are concerned more broadly with social development and community wellbeing; or rather, they are “economic” in the word’s

original sense of “to take care” (Stiegler 2014). These projects rely on practices of care of technological objects and infrastructures, care for others, and care of the self.

Many TS initiatives are concerned with the care of technological systems and objects. This care is based on a recognition of the growing importance of these systems to everyday life and the need to maintain and improve them in order to support their social functions. As one Guifi actor explained: “Internet access isn’t a luxury anymore, it’s almost as important as having electricity. People rely on it to work, to communicate with family, to manage their money. So, we need the network to be reliable” (fieldnotes, 26 June 2016). Recognizing this, Guifi members organize themselves to fix technical issues when they arise and to continually improve the infrastructure by experimenting with and integrating innovations, like fiber optic cables.

This care is based on a rejection of capitalist models of programmed obsolescence and a series of practices meant to extend the usable life of devices and systems. eReuse coordinates the reuse of devices within communities until all use-value has been depleted, combatting “premature recycling” (Franquesa and Navarro 2018). Events like the Mobile Social Congress often include “Re-Start Parties” in which activists teach people how to extend the lives of their devices. In Guifinet, when one piece of equipment is replaced in order to strengthen the network, the old equipment is moved elsewhere in the network where it can take on a new use. The association La Mar de Bytes makes use of second-hand and recycled equipment to maintain community-managed servers for web-hosting and email. Such practices are based on a commitment to responsibly manage collective resources, and a recognition of the social and environmental impacts of e-waste and mineral mining in the Global South—issues given special attention at the annual Mobile Social Congress.

TS projects are often inspired by a sense of care for others, or care for the community, with their primary objective to meet a social need or offer a social service. As such, many projects contest constructed divisions between the technical and the social, in which technical knowledge is privileged and value neutral. This is clear in cases like Colectic, where the cooperative integrates technological work with community-based social work. As cooperative member Nuria explains regarding their work with local youth: “Our work is to accompany youth in this process of learning about new technologies, so that is it not just ‘connect yourself to internet to watch whatever’ but to be critical and aware of how things work, what is happening with their data, and what these systems can be used for” (interview, 21 March 2018).

The *Ateneus de Fabricació* carry out similar work, offering public access to 3D printers and digital production technology with a focus on social outcomes and shared property. The network’s moto, “Let’s materialize ideas, let’s co-create our environment,” is based on an ethic of care oriented to the surrounding community and informed by a sense of being-in-common in urban space. Director Jordi Reynes explains that the digital production revolution will produce new forms of inequality and injustice, unless it is radically socialized. For this reason, the *ateneus* are staffed by both technologists and community organizers, who work to identify community needs, and access to the facilities requires some form of service or contribution to the community in exchange.

Finally, TS initiatives are based around practices of care for the self, in which individuals cultivate deliberate and ethical relationships to technology. This is seen in the forms of experimentation, self-help, and knowledge-sharing common at weekly Guifilabs. For instance, at one event a Guifi contributor explained the process by which he created his own home automation system and manages it through an open source platform. Such activities represent forms of

technological experimentation with one's direct living environment while gaining and sharing new forms of knowledge. In more everyday examples, for those without formal technical training the use of self-help guides to install a Guifi connection involves processes of cultivating oneself as a technological subject and reclaiming forms of technical knowledge.

Events like SobTec, MSC, and community workshops also offer opportunities for individuals to reclaim knowledge and cultivate oneself as a digital subject. Discussions at these events focus on critiques of capitalist technological models, how personal data is captured and exploited, and the ways these systems produce certain identities and senses of self—interpolating subjects as consumers. In a workshop on digital political participation organized by Colectic, the facilitators lead group reflections on the kinds of personal data shared online and the multiple ways that data is captured, monetized, and exploited. This critique is coupled with an exploration of the alternatives produced within the TS community and the ways these alternatives offer greater freedom and control over personal data. Participating in these spaces acts as form of cultivating new subject positions. These practices continually push back against widespread social and cultural conventions that see technology as a specialized sphere of knowledge on which the “layperson” majority is not qualified to opine.

#### *4.3 TS and the City*

While TS activists experiment with alternative economic relationships and practices around digital technology, they do so from within localized communities. The projects discussed in this paper place a great importance on working “from the territory.” This is based on an understanding and appreciation of difference across space, and of technology as always entangled in the social and thus always spatialized. Yet, these projects are also highly connected and networked to partners,

collaborators, and interlocutors around the globe—constituting what Stiegler (2014, 26) calls “the inscription of territory in a planetary reticularity.”

For instance, the technology/social work cooperative Colectic works specifically in the neighborhood of El Raval. As Nuria explains: “Sometimes we are asked to help facilitate some community process in another neighborhood, and we have to say no. We can have expertise in certain technologies and can maybe help in that area, but we don’t know the community. We don’t know their needs or issues. It wouldn’t be appropriate for us to lead a community process like that” (interview, 21 March 2018). Likewise, Jordi emphasizes the importance of the public 3D printing labs being rooted in “the territory”: “Every neighborhood is different, has its own needs and challenges. I can’t sit here in an office and say what will work in each neighborhood. So we have had to work from the territory [*des del territori*] talking to people about what they need and letting them lead the process, deciding what role these technologies might play in their lives” (interview, 25 July 2016).

Projects like Guifinet and TTN actively territorialize—building and maintaining material infrastructures. In both cases, relationships of proximity and the physical and social characteristics of particular spaces dictate if and how the network can be extended. Most Guifinet connections are established by antennae relaying a signal from rooftop to rooftop, requiring a line of sight from node to node. Take, for instance, one Guifinet member’s reflection on the difficulty of establishing connections in the Gothic Quarter of Barcelona: “In the Gothic Quarter it is really hard. It’s almost impossible to have a roof with a line of sight to another node because the buildings are so low and surrounded by taller ones. It’s dense, so we could run fiber optic cables, but there are so few actual residents now, it’s all tourists and short term rentals. There aren’t enough people for it to work.” (fieldnotes, 18 January 2018). The project requires working with the complex spatial relations in



which one finds oneself, including dealing with neighbors who may be opposed to having an antenna on the roof of their building, a rental market that complicates long-term occupancy, and the particular characteristics of roofs and the urban landscape. As such, Guifinet is a project of actively and deliberately co-producing the space of the city in accordance with the lived realities and needs of local residents. Doing so contests the invisibilization of the “technological unconscious” and recognizes the increasing importance of spatialized digital infrastructures to everyday life.

While all of these projects are committed to working locally, many of them are also extensively networked beyond the city. The cooperatives discussed above often work in collaborative networks with free-software programmers around the world, drawing on and contributing to a digital commons of open-source code. Representatives from Guifinet regularly work with other groups interested in building their own community-managed infrastructure, such as when Guifi participants spent a Guifilab helping the leader of an indigenous community in the Ecuadorian Amazon explore the feasibility of building infrastructure to bring internet access to his village. The annual Mobile Social Congress includes speakers from around the world—and in particular from the Global South—who come to discuss issues of human rights in electronics manufacturing, or social and environmental effects of e-waste and mineral mining.

Such connections and partnerships demonstrate the potential for alternative modes of digital development to be both deeply territorialized and attuned to the needs and conditions of particular communities, while also radically open to sharing and exchanging information, collaborating on projects, and maintaining extensive networks of solidarity. By working from within localized communities and actively reshaping the spaces of the city, the TS movement contests hegemonic “smart city” models. Yet, most of these initiatives remain rather small—

confronting the familiar issues of scale and long-term sustainability explored in much of the literature on postcapitalist economies and prefigurative urban politics. For some within the TS community, the transformation and democratization of municipal institutions offers one potential opportunity to build technological sovereignty on a broader scale.

#### *4.4 Technological Sovereignty and Municipal Government*

Emerging from a social movement base, *Barcelona En Comú* (“Barcelona in Common” in Catalan) won control of city hall in the 2015 municipal elections, led by housing activist Ada Colau. Since then, the municipal administration has embraced discourses of technological sovereignty to rethink its existing smart city program. A June 2016 op-ed by Deputy Mayor Gerardo Pisarello titled “Ciutats amb Sobirania Tecnològica” (*El Periódico*, 22 June 2016) calls on European cities to reject corporate prescriptions of the smart city in favor of a network of cities working toward TS. Meanwhile, Digital Innovation Commissioner Francesca Bria has become an active voice for alternative municipal technological models across Europe, leading the production of an “Ethical Digital Standards” municipal policy guide (Ajuntament de Barcelona 2018). Situated within a broader movement around progressive “municipalism” in Spain and around Europe, the Colau government claims the city as the ideal site and scale from which to lead radical democratic reforms, including around digital technology.

The *Barcelona en Comú* government has promoted TS through a series of changes to municipal practices with an emphasis on free software, open-data, transparency, and citizen participation. The administration has begun migrating municipal computer systems away from proprietary software packages to open-source alternatives like LibreOffice and Linux-based operating systems. This migration has created 100 new permanent paid positions for local citizens

with knowledge of open source systems and helps build and promote the broader community of open source software in Barcelona and beyond. The administration has also changed municipal contracting guidelines to give leverage to local cooperatives and firms based on open-source technology and social consciousness, and have implemented programs and subsidies to support cooperative and commons-based enterprises.

*Decidim* [We Decide] is a municipal project to create an open-source digital platform for citizen participation, in which citizens can make proposals and contribute to the development of municipal initiatives. The platform was developed by a broad community of activists and technologists and is now used by municipalities, cooperatives, and other organizations across Europe. The *Ateneus de Fabricació* are projects of the municipal government, receiving their funding from the city, while several of the collectives discussed above work out of self-managed community spaces owned by the municipal government.

Municipal support has helped promote TS initiatives and worked to imagine an alternative municipal model. Yet, such alliances also bring concerns and limitations. Beyond fears of co-optation or state surveillance, municipal priorities also change regularly with electoral cycles and are limited by the structures of the institutions. As such, despite progressive changes since 2015, Barcelona continues to host large corporate technology events and continues to encourage myriad forms of investment from large technology firms, reflecting what some activists see as the administration's broader failure to break with the city's capitalist development model and posit a real radical alternative (Delgado 2017). At least some of the shortcomings of the administration stem from the lack municipal authority in relation to regional and national governments; while *Barcelona En Comú's* lack of a majority on the city council further limits their ability to implement radical changes. Yet, it is also important to consider the limits of what can be accomplished through

current forms of administrative power and the dangers of looking toward that state as a solution. Thus, while many projects benefit from municipal programs and many activists see the city as the territorial base of digital transformation, most TS initiatives remain autonomous.

## **5. Conclusion**

This paper has explored the possibilities for alternative modes of digital development in urban life through the example of a movement toward “technological sovereignty” in Barcelona—an informal network of initiatives experimenting with locally-rooted postcapitalist digital economies. This discussion makes several significant contributions to geographic scholarship. First, it moves beyond the now well-established critiques of the “smart city” to consider the ways traditions of prefigurative urban politics and experiments with postcapitalist economic models may offer possibilities for re-thinking digital urban futures. A rejection of contemporary “smart city” programs does not need to mean a rejection of digital innovation and development, which instead can become loci for imagining and building alternatives. Second, by engaging existing literature on urban politics and alternative economies, I highlight the way emerging digital technologies open possibilities for pursuing different political economic logics and experimenting with alternative practices. Digital technologies can facilitate new forms of political organizing and democratic decision-making, and can help drive new arrangements of work, property, production, and consumption in urban life. Further, by framing technological sovereignty as just one of multiple entangled “sovereignties”—conceptualized around food, energy, culture, health, etc.—the TS movement raises important questions about the complex, entangled, and far-reaching nature of ongoing processes of digitalization and the dangers of leaving these processes to capitalist firms.

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## APPENDIX B

### **Re-Claiming the Digitally-Mediated City: Spatial Knowledge, Digital Infrastructure, and the Work of Amateurs**

\*\*\*In Review at *Environment and Planning C: Politics and Space*

**Abstract:** This paper examines the practices of Guifinet—a community wireless network in Catalonia, Spain. The largest such project in the world, Guifinet actors build and maintain their own broadband internet infrastructure through forms of de-centralized grassroots organization and experimentation with new digital technologies. I position this discussion in relation to literature on the “automatic production of space” (French and Thrift 2002) or the “transduction of space” (Kitchin and Dodge 2011), which highlight the agentic capacities of connected infrastructures and digital devices to produce and reproduce space. Despite calls to politicize processes of digitalization and the broader techno-social relations of the city, how these digital infrastructures might be made more democratic, transparent, and “for the people” (French and Thrift 2002) remains unclear. I draw on Bernard Stiegler’s notion of proletarianization as the loss of knowledge, to argue that the automatic production of space as it is commonly described functions as a proletarianization of space—or the loss of urban residents’ knowledge of the spaces they inhabit and help produce. I present Guifinet as a project of spatial “de-proletarianization”—as amateur actors re-claim knowledge over the processes of spatial production, and iteratively employ that knowledge to remake digital infrastructures.

**Key Words:** Urban Space, Digital Infrastructure, Knowledge, Grassroots Organizing

## 1. Introduction

In their 2002 article, “The Automatic Production of Space”, Thrift and French argue that “software has come to intervene in nearly all aspects of everyday life and has begun to sink into its taken-for-granted background” (Thrift and French, 2002: 309). In the conclusion of that article, the authors write: “One of the more pressing contemporary political tasks must therefore be to design friendlier 'information ecologies' (Nardi and O'Day 1999) that, because of their diversity of outcome, will allow us to shape overlapping spatial mosaics in which effective participation is still possible and still necessary. *Automatic can be for the people*” (Thrift and French, 2002: 331 *my emphasis*).

Since that time, many scholars have explored how urban space is produced, managed, and governed through increasingly complex systems of connected digital devices, sensors, data, and software code (Kitchin and Perng, 2016; Leszczynski, 2016; Marvin and Luque-Ayala, 2017; Shelton et al, 2015). Particularly influential has been Kitchin and Dodge’s (2005) theorization of the “transduction of space”—an ontogenetic theory that highlights the way space is always in the process of production, always being brought into being, assisted by assemblages of software, hardware, and data.

Yet, despite this abundance of scholarship, the question of how such systems might be “for the people” remains continually elusive. As Rose (2017) points out, much of this work lacks a clear theorization of *human* agency. Indeed, most accounts of the automatic production of space highlight the agentic capacities of technological systems and describe the mostly passive interactions of urban residents with these systems. For this reason, I argue that conceptions of the automatic production of space have yet to be fully politicized. While scholars have highlighted how power operates through such spatialized devices and infrastructures (Graham et al, 2013;

Klauser et al, 2014; Vanolo, 2014), and how they create new or reshape existing urban inequalities (Gilbert 2010), they have explored less how such relationships between urban residents and digital systems may be open to alternative configurations, and thus alternative relationships of power.

This article takes up this call by reframing the literature on the automatic production of space and the “digitally-mediated city” (Rose 2017) through the lens of Bernard Stiegler’s notion of “proletarianization” as the process of losing knowledge. I argue that the increasing governance and production of urban space through code, data, and connected infrastructures represents a particular form of proletarianization, constituted on urban residents’ loss of *spatial* knowledge. The automation of spatial production relies on the rationalization and control of urban knowledge production, through which urban citizens are deprived of basic knowledge of the processes through which the spaces they inhabit are produced and governed. Yet, following Stiegler’s conception of technology as a *pharmakon*—as both poison and remedy, and thus requiring care—such relationships to technological systems are not inevitable but rather the product of a particular grammarology, or spatial and temporal organization of technical objects within broader socio-technical assemblages. Thus, Stiegler stresses the possibility for processes of *de-proletarianization*, constituted as the reclaiming of forms of knowledge, the fomentation of individual and collective *capabilities*, and experimentation with new techno-social practices.

To consider the possibilities for such processes of de-proletarianization in relation to the production of space, this paper explores the practices of Guifinet, a community-wireless network operating across Catalonia, Spain, in order show how they enable—and indeed are dependent upon—processes in which urban residents collectively reclaim knowledge of the spaces they inhabit and help (re)produce. Guifinet actors build and maintain community-managed broadband infrastructure. These practices are dependent upon multiple forms of iterative technological

knowledge production and application, as actors build, maintain, and experiment with different aspects of the common digital infrastructure. Yet, this technological knowledge is always embedded and entangled in the broader socio-spatial relations of the city, involving not just knowledge of technological systems, but also over political, social, and economic processes of urban change.

In exploring how Guifinet actors produce and utilize complex, entangled spatial knowledges to build and maintain their own urban digital infrastructure, I build on previous work by Powell (2008; 2016), Leontidou (2015), and Corsin Jimenez (2014) who draw attention to the practices of informal grassroots techno-social projects as representative of different models of human-technological relations in contemporary cities. I also take up Elwood and Leszczynski's (2018) call for a feminist digital geography "*empirically* grappling with the complexities of the significance and implications of digital technologies in the daily lives of actual people," leading toward the "possibilities of a liberatory digital politics for re-making our technologies and ourselves as digital subjects" (p. 639-640).

Below, I briefly discuss my methods and then introduce Guifinet and situate it in contemporary urban techno-politics in Barcelona. Section 2 reviews the existing literature on the automatic production of space and the digitally-mediated city, and then reframes these conversations through the lens of Stiegler's notion of proletarianization before turning to the possibilities for de-proletarianization, highlighting the role of amateurs. Section 3 discusses the processes of amateur "technological" knowledge production and sharing within the Guifinet project. Finally, Section 4 explores how these forms of amateur "technological" knowledge are spatialized and entangled in the broader techno-social relations of the city. Through this, I examine the ways knowledge of urban space is re-claimed and shared through such projects, and how that

knowledge is put to use in re-shaping urban spaces and infrastructures according to alternative, radically-democratic logics.

### *1.1 Methods*

The discussion of Guifinet is based on more than a year of ethnographic fieldwork carried out in Barcelona over several periods between 2016 and 2018. During this time, I attended meetings and workshops, participated in online forums and group chats around the project, and conducted 20 key informant interviews with individuals associated with Guifinet and a broader movement around “technological sovereignty” (hereafter, “TS”) in Barcelona. I also installed a Guifinet node in my own home and joined the local Guifinet association for the El Carmel and Horta neighborhoods of Barcelona. Further, I examined a series of self-help documents and YouTube videos produced within the Guifi community to instruct others about how to install their own nodes, or troubleshoot problems with existing nodes. Throughout this time, I kept detailed fieldnotes about my experiences, observations, and interactions with others involved in Guifinet and the broader TS community.

### *1.2 Situating Guifinet*

Guifinet is the largest community wireless network (CWN) in the world with over 35,000 active nodes as of 2018, spanning across Catalonia and reaching into other regions around Spain. While there are multiple approaches to CWN’s, in general such projects work to build and maintain internet connections through community-managed infrastructures—often relaying and sharing wireless signals through rooftop antennas (Jungnickel 2014; Cardullo 2017; Powell 2008). Begun in the early 2000’s as a way to bring internet services to towns and villages outside the infrastructural range of private Internet Service Providers (ISPs), Guifinet has grown and adapted over the years fueled by a combination of political principle and necessity. Many Guifinet

supporters believe that internet access is a vital aspect of contemporary life and should not be left in the hands of for-profit private enterprises—highlighting abusive business practices, cooperation between ISP's and governments for surveillance, and concerns about the future loss of net neutrality.

Guifinet functions through ad hoc, decentralized forms of territorial organization. Generally, each active neighborhood, town, or village has its own autonomous Guifi association that organizes the building, maintenance, and expansion of a common broadband internet infrastructure. Guifinet associations manage their own servers, lay fiber optic cables, and relay internet connections through rooftop antennas (Figure 1; Figure 2) to deliver internet access to individual homes, community centers, public spaces, or local businesses. Local associations decide how to pool resources, designate work tasks, and coordinate or cooperate with other Guifi associations, neighborhood associations, non-profits, and local governments in order to support the network. Larger foundations or associations, like the FundacioGuifi or eXo work to coordinate and represent the broader network at the city and regional levels. Beyond basic broadband internet access, Guifinet has begun expanding their work into the realm of the Internet of Things (IoT), sponsoring research into DIY, open-source home automation technology, known as CanGuifi, and partnering with The Things Network-Catalonia, a local branch of an international association devoted to open source IoT sensing with a focus on addressing social concerns.



Figure 1: A “supernode” antenna relaying a wireless internet signal to individual nodes.



Figure 2: An individual “node” or connection point receiving a signal from a supernode.

## 2. The Digitally-Mediated City and the (de-)Proletarianization of Space

Before addressing the practices of Guifinet in more detail in the following sections, I first review the existing literature on the emergence of the digitally-mediated city and the automatic production of space, highlighting the lack of discussion around possible alternatives to hegemonic state and capital-led processes. I then reframe this literature through the lens of Stiegler’s understanding of proletarianization, arguing that common trajectories of urban digitalization often constitute processes of *spatial* proletarianization—or the loss of spatial knowledge. Finally, I examine Stiegler’s call for processes of *de*-proletarianization and highlight some existing literature in geography and urban studies that point to those possibilities.



## *2.1 The Automatic Production of Space and the Digitally-Mediated City*

Writing in 2002, Thrift and French explored the multiple spaces in which software had begun to be deployed in everyday life—highlighting the growing role of software in cars, elevators, mobile phones, and the emergence of “wearables”. They argue that these devices play increasingly important roles in producing space, and highlight the political implications of these developments, writing that “software challenges us to understand new forms of technological politics and new practices of political invention, legibility and intervention that we are only just beginning to comprehend as political at all” (Thrift and French, 2002: 331).

Kitchin and Dodge (2005) build on Thrift and French’s insights in their theory of the “transduction of space.” They explore the nature of code, through a discussion of coded objects, coded infrastructures, coded processes, and finally coded assemblages—composed of complexly interdependent and entwined objects, infrastructures, and processes. The authors argue that “the power of these assemblages is their interconnection and interdependence, creating systems whose complexity and power are much greater than the sum of their parts” (Kitchin and Dodge, 2005: 164). They conclude that “code, to varying degrees, conditions existence” (ibid.).

Based on this understanding of the role of coded assemblages in everyday life and spaces, Kitchin and Dodge explain the transduction of space as an ontogenetic theory of space, in which such everyday processes are understood to actively bring space into being. Kitchin and Dodge (2005: 174 my emphasis) argue that:

this conceptualization of space as an ontogenetic, collaborative manufacture does not deny the salience of structural forces such as political economy or capitalism or neoliberalism or institutional structures such as the state and its agencies; rather, it refigures all of these elements as sets of ongoing, relational, and contingent discursive and material practices that are citational and transformative. These practices, too, are in a state of ontogenesis, always being remade in ongoing processes, and inducing transductions in collective life. These structures do not sit outside of collective life, but

are *(re)made through its performance*, providing citational context at the same time that they are perpetuated.

Referencing Butler's performativity, the authors see the processes by which space is transduced through code to be largely unconscious, as the repetition of particular processes and relations come to seem natural and thus taken-for-granted. As they "fade into the background," these vast material assemblages that significantly shape everyday life have been described as the "technological unconscious" (Clough 2000; Thrift, 2004)—only becoming visible when they stop working as intended. Yet, significantly, an ontogenetic, performative understanding of space precisely opens the possibility to remake space through alternative practices and performances.

Scholars have explored in depth how such processes of technologizing urban space have accelerated in recent years with the emergence of so-called "smart city" development models, based primarily on the extensive rationalization of urban processes through the implementation of connected sensor networks and the collection and analysis of data (Crang and Graham 2007; Kitchin and Perng 2016; Batty, 2013). They have considered the ways the proliferation of screens and new forms of visualization, environmental sensors, and other coded infrastructures re-configure spatial relations in efforts to further rationalize urban processes and securitize urban futures. Scholars and urban residents alike have critiqued these models for implementing new forms of technocratic governance with limited democratic oversight (Lesczynski, 2016; Gabrys, 2014; Luque-Ayala and Marvin, 2015; March and Ribera-Fumaz, 2016).

Others have critiqued such programs for privatizing vital aspects of urban government, or have highlighted their role within broader processes of capitalist development and evolving forms of entrepreneurial urbanism (Söderström et al 2014; Wiig 2015). For instance, Marvin and Luque-Ayala (2017) trace the emergence of Urban Operating Systems, showing how particular forms of knowledge production about the city become organized and concentrated in the hands of corporate

capital. Within this critique, they point to emerging forms of control, writing: “Underpinned by modularity, transferability and an alleged flexibility, this diagrammatic of control is based on functional simplification and selective integration. It implies the establishment of narrow channels for knowledge circulation alongside specific forms of decision making” (p. 90). The development of digital infrastructures in the city is used to rationalize and control processes of spatial knowledge production—channeling that knowledge into tightly controlled processes of urban governance.

Yet, despite these many critiques and the acknowledgement that that production of space through code is an ongoing, contingent, and performative process, there is little engagement with how those processes might be performatively contested or re-made differently. As a response to the numerous critiques of smart city development models, companies and municipal governments have begun calling for “citizen-centered” approaches to the smart city, usually through experiments with civic hackathons, living labs, and other forms of citizen participation. Yet, the models of “participation” around which such smart city revisions have been based have tended to lack a radical democratic impulse and reinforce existing logics and relationships of power (Tenney and Sieber 2016). In attempting to classify different models of citizen participation in smart city programs, Cardullo and Kitchin (2018) argue that the majority of participatory approaches rely on neoliberal conceptions of citizenship, focused on market-led solutions and a sense of individual responsibility. Cardullo et al (2018) highlight a similar occurrence in the case of “living labs” and civic hacking initiatives, finding that they rely on paternalistic relationships and are narrowly framed within projects of neoliberal urban transformation. In these cases of “participation,” citizens are enrolled to produce knowledge for use in the existing structures of neoliberal urban governance. They do not gain and employ that knowledge themselves to exercise new forms of

control over the spaces in which they live—but become enrolled in broader, rationalized, and controlled socio-technical assemblages.

## 2.2 *The Proletarianization of the Urban Citizen and the Loss of Spatial Knowledge*

Reflecting on this vast literature around the digitalization of urban space, I argue that many of the processes and cases described in the literature could be understood as a particular form of proletarianization—the proletarianization of the urban citizen, constituted on the loss of spatial knowledge. Stiegler’s critique of political economy revises Marx’s notion of proletarianization—framing it as a “process of losing knowledge” (Stiegler 2010, 38) facilitated by a particular “grammatizations” of technology in social, political, and economic life.

In Stiegler’s use of the term “proletarianization”, the process described by Marx as the devaluation of labor through the organization and integration of machines and workers’ bodies in the production process represents just one form of proletarianization constituted by workers’ loss of *savoir-faire*, or knowledge of production. Stiegler (2010) describes further processes of “cognitive and affective proletarianization” (p. 30) constituted by the proletarianization of consumption—or knowledge of ways of living—and of theoretical knowledge. Drawing on Deleuze’s (1992) “Postscript on Societies of Control,” Stiegler (2010) sees the proletarianization of consumption in the increased use of media technologies in the 20<sup>th</sup> century to capture attention and occupy available brain-time. The integration of new technologies in consumption and leisure-time under contemporary capitalism works to control populations and deprive individuals and collectives of *savoir-vivre* or “knowledge of living.” A third phase of proletarianization is constituted by the loss of theoretical knowledge, given over to calculation and algorithmic decision-making in the ongoing era of “cognitive capitalism.” In this phase, the creative and critical

capacities of designers and “knowledge workers” are short-circuited and integrated into increasingly complex socio-technical milieus of which they have limited knowledge and authority.

These processes of proletarianization are thus the product of ongoing processes of technocapitalist development, in which technologies are enrolled in complex assemblages that work to rationalize and control. Through this, individuals and communities are systematically deprived of essential knowledges, including knowledge of how technologies work, how they affect and influence people’s lives and actions, and the knowledge needed to understand and critically analyze the complex systems in which one lives.

Approaching the digitally-mediated city through this lens, I argue that many of the insights and arguments put forward in the literature demonstrate how key forms of *spatial* knowledge are lost to most urban citizens with the implementation of new digital infrastructures. Much like the use of technology in industrial production processes, the control of leisure time, and increasingly in processes of complex decision-making and “knowledge work”, digital technologies are increasingly used to rationalize and control the production of urban space. Marvin and Luque-Ayala’s (2017) previously mentioned work on Urban Operating Systems for instance, highlights the ways such projects create “narrow channels of knowledge circulation.” Rose’s (2017) critique of work on the digitally-mediating city for undertheorizing forms of *posthuman* agency also highlights the ways knowledge production is seen to take place increasingly within the confines of technological systems—one in which human actors are present, but are not seen as key actors. Rather than see this as a failure of smart city scholarship, this focus on the agency of technological systems over that of “human” actors could be understood as reflective of the processes of proletarianization at work—as the spaces for critical human action within such systems become increasingly constrained. Finally, the many critiques of smart city projects as technocratic (Kitchin

2014) and the calls for creating more spaces for “citizen participation” (Cardullo and Kitchin 2018) are clear reflections of this process of proletarianization—as urban residents lose essential forms of knowledge and thus decision-making power over urban processes with the integration of new digital infrastructures.

### *2.3 De-Proletarianizing Spatial Knowledge in the Digitally-Mediated City*

Yet, significantly, Stiegler argues that proletarianization is not somehow the inevitable consequence of technological development, but rather is produced by a particular grammatization—a particular relationship to technology and logic of organization that deprives individuals of knowledge and subjects them to the logic of a hegemonic system. As such, socio-technical relations are always open to processes of re-invention, or re-organization. Describing the possibilities for “de-proletarianization”, Stiegler calls for processes of reclaiming knowledge, gaining new capabilities, and experimenting with new forms of socio-technical organization, highlighting the figure of the *amateur*. As Dillet (2017) explains: “For Stiegler, the amateur is a revolutionary agent, since in the age of generalized proletarianization and surplus population, and far from representing the public at large or the consumer in the ‘sharing economy,’ the amateur is an active participant in social circles, a producer of new practices, new discourses and artefacts.”

In her engagement with Steigler, Rose (2017) offers a theoretical approach to posthuman agency in the digitally-mediated city based around processes of reinvention with technological objects and systems. She highlights the ways urban residents differentially interact with and make use of urban technologies in their daily lives, enacting different spatialities and temporalities. Rose (2017) describes these enactments as “embodied practices through which posthumans watch, touch, learn, think, hear, move, and gesture, in streets, squares, parks, and workplaces, mimicking, recombining, and reinventing” (p. 786). While Rose focuses primarily on the ability of urban

residents to differentially make use of and interact with digital devices and other technologies, I argue that her theorization of posthuman agency is also useful for thinking through the possibilities for more direct actions focused on challenging control over the infrastructures and devices themselves and experimenting with more radically alternative forms of spatial and temporal organization.

In thinking through the possibilities for processes of de-proletarianization, I build on the work of several authors who have written about similar grassroots techno-social projects, arguing that they offer examples of alternative, more radically-democratic models of urban technological development in opposition to capitalist regimes of property, efficiency, and security (Powell 2008 and 2016; Leontidou 2015, Corsin Jimenez 2014). Corsin Jimenez (2014) examines the development of open source infrastructure and hardware through the project *Inteligencias Colectivas*, coordinated through Zoohaus, a guerrilla architecture collective based in Madrid, Spain. The author highlights how the project claims a “right to infrastructure” through processes of documenting and sharing knowledge about practices of actively producing one’s own urban spaces—drawing inspiration from practices of urban informality in the global South. In a related move, Leontidou (2015) reflects on the case of Athens and the ways highly-educated, un- or under-employed youth in the context of a retrenched crisis of the capitalist economy pursue projects of “grassroots creativity” that stand to challenge hegemonic notions of the “smart city.” Such cases compellingly demonstrate Rose’s (2017) notion of posthuman agency in the digitally-mediated city as a process of *reinvention with* technological assemblages, rather than a rejection of or resistance against their agentive capacities. They also demonstrate the way these forms of radical reinvention rely on practices of amateur knowledge production and sharing that make visible the forms of power and knowledge on which processes of urban change rely.

### **3. Producing and Sharing Technological Knowledge**

As urban space and everyday life become increasingly dependent on digital technologies and infrastructures, re-claiming spatial knowledge and thus control over processes of spatial production depends on the democratization of “technological” knowledge. Guifinet works to make technological knowledge accessible and meaningful to a broader public across Barcelona and Catalonia. One way they do this is through a series of self-help guides and videos explaining basic aspects of network technology and how to complete basic tasks in setting up a node or troubleshooting connectivity issues. Further, at weekly “guifilabs” in Barcelona, speakers frequently give presentations explaining key technical aspects of the Guifinet project. Beyond this, some Guifi actors conduct new experiments in open-source technology for use in the broader community. In this section, I focus on three examples of amateur technological knowledge sharing. I first focus on the DIY guide for installing a Guifinet node in the El Carmel and Horta neighborhoods. I then examine a Guifilab presentation in which the speaker explained the electromagnetic spectrum and its importance to Guifinet activities. Finally, I discuss the Can Guifi project, an experiment in DIY, open-source home automation. Across these examples, I highlight the way “technological” knowledge is produced and shared in the community, and how that knowledge is embedded in local contexts and entangled in broader socio-spatial knowledges. This represents a radically different model to the “functional simplification” and “narrow channels of knowledge production” (Marvin and Luque-Ayala 2017: 90) on which “smart city” and related models are based.

#### *3.1 Do-It-Yourself Install Guides*



The Guifi community makes use of Do-It-Yourself (DIY) guides for a number of purposes, including giving instructions for setting up a new node in the Guifi network and for troubleshooting common connectivity issues. Many versions of these guides exist, as they are frequently updated to reflect changes in the network, and as each decentralized Guifi association is organized slightly differently. In September 2017, I used one of these DIY guides to set up a Guifi node in my own home in Horta, a neighborhood on the outskirts of Barcelona. The guide I used, while similar to other available guides in the broader Guifi community, was prepared specifically by and for members of GuifiAmunt—the Guifi association for the neighborhoods of El Carmel and Horta.

Before using the guide, I contacted one of the local organizers and explained that I wanted to connect to the shared network. We met up in local plaza to discuss the matter and he explained to me roughly how the network is set up in the neighborhood. They have three main “supernodes”—or main network relay points—to which the individual nodes are connected (Figure 6). In order to connect, I needed to find a place—typically on the roof although sometimes on a balcony or terrace—from which an antenna would have a direct line of sight to one of the supernodes. Later that evening, I texted him a panoramic photo from my terrace and he sent the photo back with a box indicating where the closest supernode is located (Figure 7). He then sent me the guide for setting up a node and told me what kind of hardware I would need, in this case a Mikrotik Routerboard SXT 5HnD—a small antenna compatible with the existing infrastructure, costing around 60 euros—a 10-meter-long Ethernet cable, an extension cord, and a wireless router.

If I needed assistance, he gave me contact numbers of several other local experienced members who might be able to help.

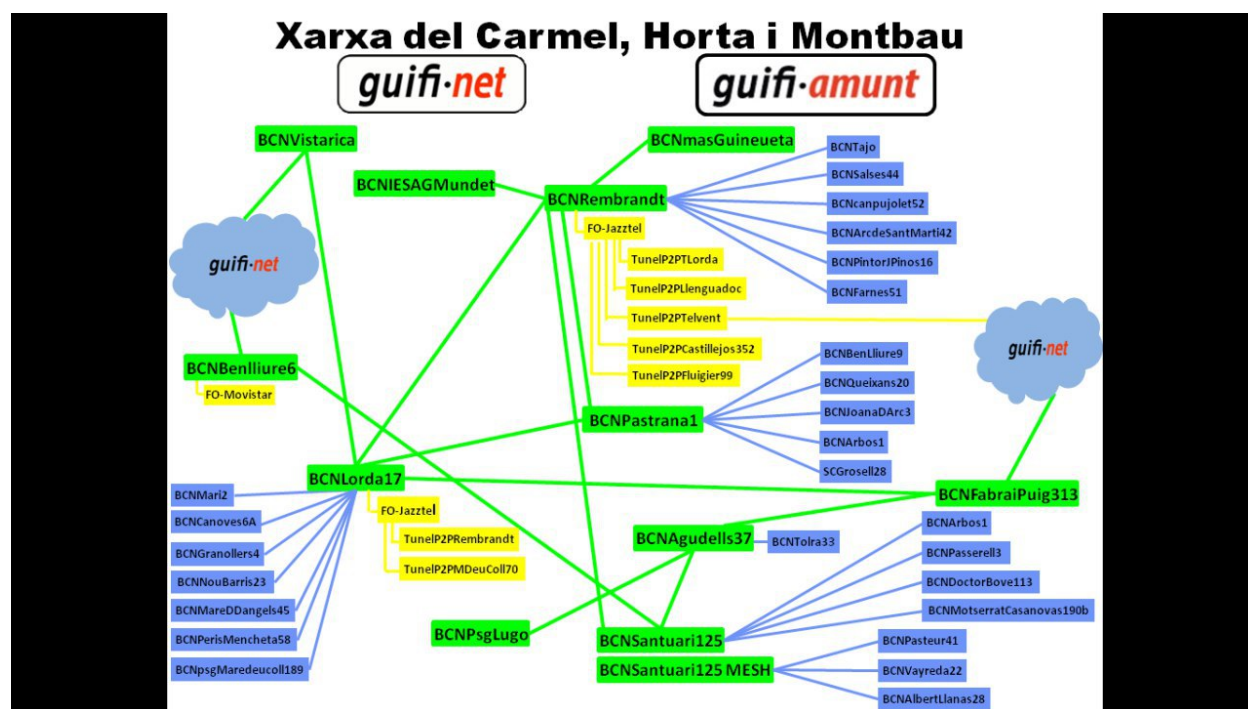


Figure 3: A conceptual map of the local Guifi network in the El Carmel, Horta, and Montbau neighborhoods. Showing "supernode" connections in green and individual nodes in blue. CREDIT: GuifiAmunt.



Figure 4: View from my terrace in Barcelona with the location of the Rembrandt supernode marked with a yellow box.

The guide, written in Catalan, is simply titled “How to create a username, node, device, connect and configure the antenna and the proxy” and is divided into seven main steps, plus an “Annex” answering common questions, like “What is an IP address?” and “What is a MAC address?” The guide offers step-by-step instructions and explanations from creating an account and registering a node within the broader Guifi platform, to setting up and configuring the antenna

and connecting to the internet through a proxy. One of the primary steps involves adding the new node within the Guifinet map (Figure 8, Figure 9), including adding latitude and longitude and the approximate height of the antenna above street level, and then designating to which supernode it will connect. Based on the information entered about the new node, the system then models its spatial relation to other nodes and supernodes in the area—showing distance, height difference, strength of signal, and any potential interference or obstacle between the nodes. While this system is meant to assess the feasibility of a potential connection between two nodes, the guide also instructs the user to conduct a real-life test—setting up the antenna and testing its connection to surrounding nodes. Once this connection is defined in the Guifinet system, the guide instructs the user to enter information about the particular antenna or other hardware being used. It also explains why this information is needed and where it can be found on the antenna itself or its accompanying materials.



Figure 5: Map of Guifinet nodes. Screenshot from <https://guifi.net/ca/node/2413/view/map> (accessed 27 February 2019)

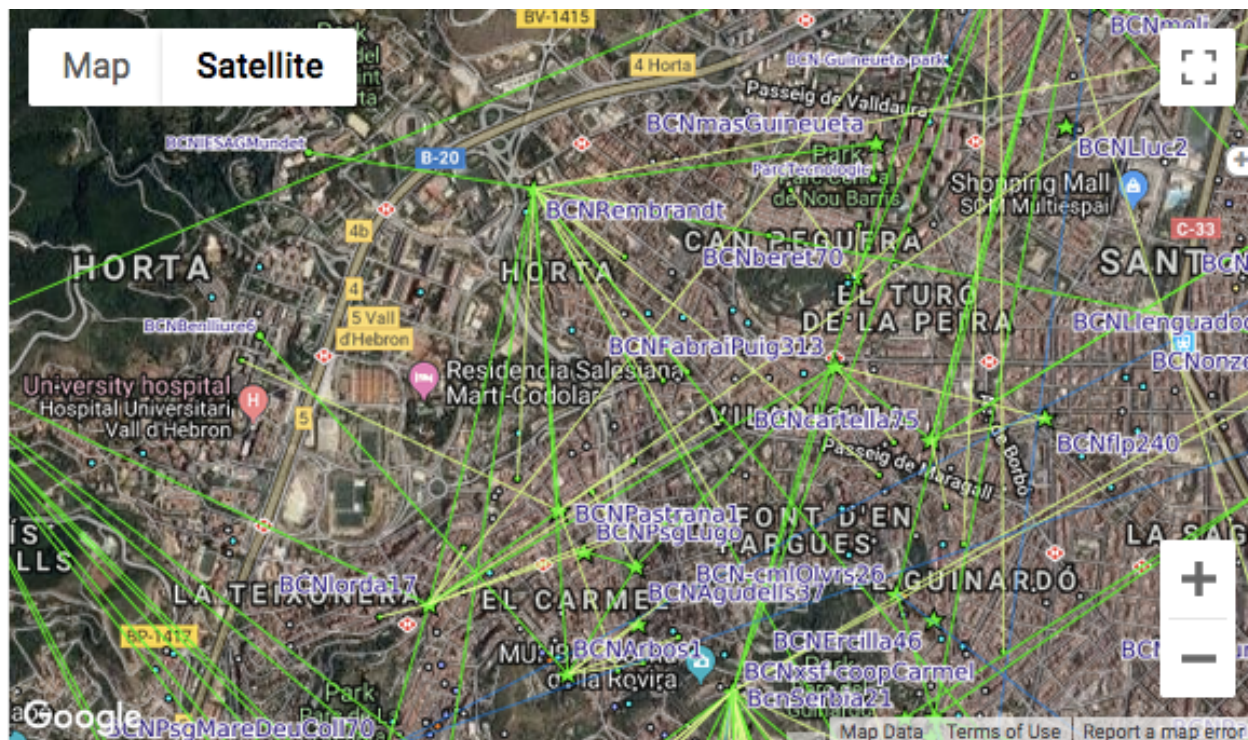


Figure 6: Guifinet map zoomed in to the Horta neighborhood. Screenshot taken from <https://guifi.net/ca/node/2413/view/map> (Accessed 27 February 2019).

Another of the primary steps focuses on configuring the antenna to complete the connection to the supernode. The guide walks the user through accessing the operating system of the antenna, scanning for possible connections, finding and selecting the correct signal, and entering the needed information to establish a connection—including IP addresses for the supernode and the local Guifi Domain Name Servers (DNS). The user is then instructed to test the connection by opening a systems window and “pinging” the IP address of the supernode. Once this is done, the guide gives instructions for how to connect to the internet through a proxy. Most of Guifi infrastructure functions as a private network. The user must then connect to the internet through a proxy—one of the Guifi nodes with a direct internet connection. The guide explains how to enter the Internet configuration options in Windows, Apple, and Ubuntu operating systems and where to enter the IP address of the proxy connection, in this case for a supernode named BCNLorda17. With this completed, the antenna should be connected to the local Guifi network, and through it to the

internet. The user can then connect the antenna to a wireless router using a standard Ethernet cable and configure the router to supply wireless internet access to a given flat or space.

In following these instructions, the user learns step-by-step the basics of wireless networking, including its reliance on particular sets of material infrastructures, their spatial relations, and the protocols through which connections are created. The user is also able to see how they fit within the broader network— which other nodes exist, how they connect to each other, and what roles each play as end-point connections or as relay points between nodes. This experience, facilitated by the DIY connection guide, allows Guifinet users to gain key knowledge about the infrastructures they rely upon—including how it works, who builds and maintains it, and how it is spatially situated within their lives. This experience contrasts more typical examples of urban digital infrastructures in which the vast majority of residents have exceedingly limited access to knowledge about how they work, what they do, who controls them, or even where they are located. Further, while the ubiquity of internet connectivity has been argued to create new forms of spatial displacement—as users interact with others and access information in faraway places—the process of setting up one’s own internet connection makes exceedingly visible the local socio-spatial relations on which such connections always rely, even when supplied by a private Internet Service Provider.

### *3.2 Guifilab*

In September 2017, I attended a guifilab meeting held at the Can Felipa community center in the Poblenou neighborhood of Barcelona. This particular guifilab featured a formal presentation titled “Radio Communications and the Regulation of the Spectrum.” The presenter, an experienced Guifi member, aimed to give the audience a basic understanding of the electromagnetic spectrum

(EMS), how it is regulated, and its importance to Guifinet activities. Through this, he also explained the various ways Guifi associations build internet infrastructure and their relative pros and cons.

The speaker, Joan, started with the very basics, explaining the difference in wavelengths, from radio waves to gamma rays. The waves used to transmit information through guifi and other wireless networks are radio waves, on the larger side of the spectrum. Smaller wavelengths, like gamma rays, can be harmful to human health, while the longer wavelengths are not. Joan stressed this point at several moments throughout the presentation, seemingly because it is a question often raised by neighbors and others who are concerned about Guifinet projects in their building or neighborhood, fearing it may have negative health effects. Joan explains how questions of power and frequency affect which kinds of antennas Guifi projects use, with longer wavelengths requiring larger antennas. He also explains that communications of the same wavelength can interfere with one another, and that as the waves are transmitted through the air they can face interference from other environmental factors. The benefit of fiber optic cable is that the communication is contained within the cable and thus faces less interference and no conflicts with other waves. Fiber optics basically allows more channels of communication to be open at one time. While Guifinet projects do make use of fiber optics for this reason, it is not currently a feasible option for most of the Guifi network.

Joan then moved into a section titled “Who controls the waves?” in which he explained the different regulations and regulatory relationships around radiowaves. He mentioned the International Telecommunication Union, which divides the world into 3 regions—essentially, the Americas, Asia, and Europe/Middle East/Africa—each with a distinct allocation of radio wave frequencies. Within the EU, the European Conference of Postal and Telecommunications

Administrations creates common directives for the management and allocation of radio waves, and national regulations in Spain are managed by the Ministry of Industry, Tourism, and Commerce.

The *Ley General de Telecomunicaciones* (or General Law of Telecommunications) sets regulations nationally, with Article 5 allocating different frequencies to different uses, including set frequencies for the “public domain” including “commons,” “special,” and “private” uses. Article 11 further explains the common use of the public spectrum. Joan explained to the audience that the other frequencies are privately held or otherwise reserved. Access to these frequencies and the hardware needed to make use of them is very expensive, whereas Guifi relies on the use of the public domain as a “commons.” The limitation of this is that it is a finite and shared resource. Joan uses the example of water to demonstrate, drawing a comparison between public domain frequencies and a well in a small village. If everyone uses too much, the resource becomes strained. It thus needs common management and protection against unnecessary or wasteful use. Joan ended his talk with a discussion of different kinds of antennas used in Guifi projects and what their power and frequency settings mean for the practical task of building new infrastructure.

This event demonstrates another way that Guifinet members work to spread and share basic technological knowledge in order to encourage amateur technological practices in the city. While detailed knowledge of the EMS is probably not necessary to carry out basic tasks in Guifinet projects, understanding it and how it is regulated is useful for making informed decisions about future infrastructure extensions or upgrades, for ensuring Guifi activities stay within legal uses of the public domain spectrum, and for reflecting on the EMS as a shared resource whose use is shaped by numerous limitations and relationships of power and access. This knowledge is also useful for assuring neighbors and others who might have concerns about risks associated with radio waves. Such practices share technological knowledge necessary for producing and

maintaining digital infrastructure while embedding that technological knowledge in its broader legal, political, social, and spatial entanglements.

### *3.3 CanGuifi*

In May 2018, I attended a Guifilab in the Raval neighborhood of Barcelona. At this particular meeting, two Guifi members presented their work on the project CanGuifi, an experiment with an open-source DIY Internet of Things (IoT) sensing network designed to monitor home electricity use as part of project to fight energy poverty and the abuses of private energy companies. The project sought to develop the assemblage of hardware, software, and protocols need to carry out the project, but was driven by specific social and political concerns with the current hegemonic model of technological development in the city. As the project's public materials explain: "Can Guifi is the exploration of next generation networked services to address the inequalities that the same technologies and infrastructures produce when they are managed in a monopolistic manner." Can Guifi was thus inspired by a recognition of the way connected infrastructures are often used to spearhead increasingly exploitative business practices by private firms, in this case the increasing use of "smart meters" by private energy companies to create new pricing schemes and new forms of control and monitoring of individual energy use patterns.

The project was led by Guifinet members with supporting funds from the Barcelona municipal government and all of the materials from the project were made freely available online so they could be used and experimented with elsewhere. The project built on other ongoing experiments around the city with open-source DIY sensing technology. At a guifilab meeting in September 2017, a member presented about his own personal experimentation with an open-source, DIY home automation system. At the same time, another local group known as The Things



Network (TTN) began a partnership with Guifinet in 2017 to experiment with a series of LoRa (long range) antennas to carry out a DIY sensing project around the city.

Beyond experimenting with the particular technical apparatuses needed to carry out the project, Can Guifi also acted as an important opportunity to think through important questions around new “smart” technologies, including questions of data privacy and ownership. As a DIY project, these questions are ones that require collective reflection and debate, reconciling values and political commitments with the design, capabilities, and flexibility of technological systems. In developing this technology, project leaders hoped to form new partnerships with other local groups fighting energy poverty and with groups like SomEnergia, a local renewable energy cooperative with close to 40,000 members.

This project aimed to produce and spread multiple forms of knowledge. First, it produced new technological knowledge about how to produce low-cost, easy to use home sensing systems, and made that knowledge available to a broader public through public presentations, experiments in particular buildings around the city, and by sharing plans and information through digital networks. This aimed to give people greater knowledge about the technical devices increasingly spreading into new domains and spaces of everyday life. Second, the final product of Can Guifi is meant to give individuals and communities greater knowledge over how their energy systems work and their relationships to energy providers. This new knowledge holds the potential to inspire new counter-hegemonic practices. It could drive new membership and participation in existing renewable energy cooperatives; or, as one Guifilab attendee suggested, neighbors could create new forms of collective consumption by replacing individual energy meters with community energy meters, allowing communities to collectively control and manage their own energy consumption. In this way, Can Guifi is not a purely “technological” project, but one focused on creating new

kinds of social and economic relations, a fact most clearly articulated by the project's coinage of the term Internet of People (IoP) instead of Internet of Things (IoT).

#### **4. Techno-Social Entanglements and the Production of Spatial Knowledge**

Approaching Guifinet as an example of spatial de-proletarianization, I highlight the essential role of knowledge production and sharing in the success of Guifinet's activities, and the way these knowledges cut across any neatly defined boundaries between technological and social knowledges. These forms of knowledge fuel the production of alternative urban infrastructures that are controlled collectively and cooperatively by their users. While these self-help guides discussed above lay out the basic technological features of the network, they themselves are only a small part of the process of building and maintaining the infrastructure, which requires that Guifinet members navigate complex social-spatial environments and form community partnerships and individual social relationships. To demonstrate this, I divide this section in two parts, one describing the successful installation of new Guifi infrastructure, and another describing a case in which multiple complications and challenges prevented the extension of the Guifi network.

##### *4.1 Maintaining and Improving the infrastructure of GuifiAmunt*

Beyond connecting new nodes to the Guifi network, individual local Guifi associations organize to maintain, expand, and improve the shared infrastructure in their area. While individual members typically buy their own household antennas and routers, the network also relies on a variety of other shared hardware—like network switches, servers, and larger antennas for use at supernodes—as well as cables, extension cords, and protective cases, among other materials. As these pieces of hardware age, become damaged or outdated, they periodically need to be replaced

or updated. Likewise, as the network takes on new users or expands into new areas of the neighborhood, new hardware may be needed to create a new supernode or to handle increased traffic. These materials represent the shared costs to maintaining and expanding the network.

While each association handles these costs differently, in the case of GuifiAmunt, association members pay five euros per month toward a common fund that can then be used to purchase new hardware and other necessary supplies. Major decisions about when and how to update or expand existing shared infrastructure are made collectively at monthly association meetings, while members use a group Telegram chat to communicate about the everyday needs of the network. As a member of the association, I regularly attended these meetings and participated in the group chat. During this time, there were a series of issues that had to be navigated and resolved in the network—these issues demonstrate the complex, spatialized, techno-social entanglements navigated in regular Guifi practices.

A concern discussed at one meeting was about the future of the local neighborhood association—one of GuifiAmunt’s primary community partners. Once an important leader of local community organizing, the association was going through a difficult time. Recently, attendance at meetings and events had been declining, several of the association board members planned to step down, and there was talk of closing the association’s office—where GuifiAmunt met and hosted a server. While this closure would not affect GuifiAmunt’s primary infrastructure, the association would have to find a new space from which to manage the network. The possible future directions of the neighborhood association were a point of contention. There was some interest in petitioning city hall to hire a community organizer to come and work at the association—someone who would have the time, energy, and training to carry out the work effectively. Yet, there was concern that this would constitute a step toward the formalization and professionalization of what was up to

that point an informal, grassroots association. If the neighborhood association were to close, there was a chance GuifiAmunt could try to build a new partnership with another local community center. Yet, this again was not viewed favorably, as the community center was run by the city hall and GuifiAmunt members preferred to partner with an independent grassroots association. GuifiAmunt's discussions around this issue point to the complex and evolving socio-spatial relations that they actively navigate while building and maintaining their own broadband internet infrastructure. Building and maintaining the shared infrastructure requires building and maintaining community relations and working toward broader forms of community control and local democracy.

GuifiAmunt also managed a series of unexpected issues with the shared infrastructure, from frequent power outages at the site of a key supernode, to the breakdown of important pieces of hardware from severe weather events. For instance, during one summer heat wave, the high temperatures melted the protective covering over some cables and ended up burning out one of the antennas. In another case, high winds had blown over and damaged one antenna. Association members become aware of these issues when the internet connection is interrupted to one or more nodes, at which point the association investigates, tracing the problem back to a particular node or supernode and going to check on its status. These issues demonstrate the way GuifiAmunt's activities require forms of self-organization capable of reacting to unexpected events in the area and a continuous vigilance over the status of the shared infrastructure.

Beyond these repairs, GuifiAmunt also worked to strengthen and extend their existing infrastructure in the hopes of making it more reliable and able to bring in new members while taking advantage of new developments in networking technology. Some improvements were fairly simple, like swapping out an older antenna for a newer one—and then often using that older

antenna somewhere else in the network. Other improvements were more complicated, involving installing new pieces of hardware and reorganizing primary network connections between nodes. Such actions required knowledge over the current state of the infrastructure and an ability to imagine future possibilities for improvement. Yet, these are not simply technical calculations. Planning out the expansion and improvement of the network requires a familiarity with the materiality of the cityscape to know which connections are potentially feasible, as well as knowledge of the complex socio-spatial relations around individual nodes.

For instance, when any new node is set up on the roof of a building (typically in which one of the association members lives), all of the other residents have to be notified. Guifinet has a shared template for this notification, explaining the project and citing the Spanish law that gives individuals the right to set up private communication infrastructure in such shared spaces. Yet, in several instances, neighbors may challenge the installation of such infrastructures, often based on fears about negative health effects or suspicions about what the hardware is *really* being used for. Such social relations around the infrastructure can and does actively effect where and how the network might expand.

These examples of the everyday practices involved in the maintenance and expansion of shared infrastructure demonstrate the multiple forms of complex, entangled *spatial* knowledges gained and employed by association members. These spatial knowledges combine technical, social, political/ethical, legal, and environmental elements. Significantly, the multiple knowledges needed to navigate these processes do not reside in a single individual, but are held in common and shared through regular meetings and communication among the members, allowing for grassroots, democratic forms of organization and intervention around the production of digital urban infrastructure.

#### 4.2 *Guifinet limitations in the Gothic Quarter*

While GuifiAmunt members collectively navigate complex material, technical, political, and social entanglements in order to maintain and extend their shared infrastructure, these same entanglements place constraints on the feasibility of the Guifinet project elsewhere in the city. While several neighborhoods throughout the city have highly developed networks with many users, others do not. In particular, there are significant limitations to Guifinet expansion in the *Barri Gòtic*—or Gothic Quarter—of Barcelona. These limitations, or constraints, were the topic of discussion at one Guifilab in January 2018.

The municipal government had recently acquired a space in the building of an old art school in the middle of the Gothic Quarter and converted it into a multi-use community space as part of their plan to combat real estate speculation and promote community activities and enterprises in the historic center. A municipal representative involved in the project approached eXo, the Barcelona Guifi association, to ask them to connect the building to the common network for the space's inauguration. At the Guifilab, experienced Guifi participants discussed the possibility of doing so and almost immediately recognized it would not be feasible.

One of the first concerns raised by those in attendance at the Guifilab was that there is not a pre-existing, developed Guifi network in the Gothic Quarter, meaning finding a supernode close enough to connect to would be quite difficult. The reason for this lack of developed infrastructure, they explained, was the combination of a variety of factors, one being the physical and material cityscape of the neighborhood. Specifically, it is physically difficult to build infrastructure in the area because of the height and style of the roofs. Guifinet typically relies on antenna technology, requiring a line of sight from an antenna on the roof of a building to a supernode. Low-lying roofs, particularly when surrounded by taller buildings, as well as roofs with limited access make

connection difficult without hoisting the antenna on the top of a long pole, which can also be rather complicated. One participant raises the point that the area is rather small and dense, making it a good candidate to lay fiber optic cables, but without a large, organized community willing to support such a project, it is not viable.

This point led to another major reason there is not a developed network in the Gothic Quarter. Over the past several years the neighborhood had begun experiencing rapid changes driven by the continually growing tourism industry, and more specifically by the rise of Airbnb and similar platforms. As permanent housing has been converted into tourist accommodations and short-term rentals, the neighborhood has experienced the steady loss of long-term residents and the weakening of community ties. As Guifinet relies on forms of grassroots community organization, the lack of long-term residents means the extension of infrastructure into the neighborhood is not feasible. This is common issue in the development and expansion of community wireless networks, as Cardullo (2017) highlights in the case of the Open Wireless Network in London.

Yet another limitation to extending the Guifi network to connect the building in question involved a lack of trust in the municipal government. Since coming to power in 2015, there had been a series of discussions between Guifinet actors and the progressive municipal government in the hopes of establishing some form of collaboration. After several meetings to discuss ways the city could support Guifi activities and even move municipal connections to the community network, the group has seen very little follow through. Undertaking such a complicated expansion of the network to connect one municipal building without any kind of broad municipal cooperation simply did not seem feasible.

This particular example of the Gothic Quarter again demonstrates how Guifi actors possess and share a multiplicity of entangled knowledges about the spaces of the city. In assessing the feasibility of this particular project, Guifilab participants reflected on their knowledge of the physical and material cityscape, the capabilities of antenna and fiber optic networking technology, ongoing processes of social and economic change in the neighborhood, and their own political relations with the municipal government.

## **5. Conclusion**

Geographers have carefully examined how the development and expansion of connected infrastructures re-shape the production of urban spaces, and have thoughtfully critiqued their entanglement in evolving forms of knowledge production and decision-making. The many critiques of the “smart city” closely echo Stiegler’s discussion of proletarianization as the process of losing knowledge. This article has explored how the amateur techno-social practices of a community wireless network in Barcelona constitute an alternative regime of spatial knowledge production and sharing in the digitally-mediated city in contrast to familiar narratives about the “automatic production of space.” In the process of building, maintaining, and expanding community-managed digital infrastructure, participants in the project produce, share, and draw on multiple knowledges about the spaces of the city while gaining new capabilities.

I thus argue that Guifinet can be understood as a project of spatial de-proletarianization—or a reclaiming of shared knowledge of, and thus control over, urban space. This spatial knowledge involves an understanding of the complex entanglements of technological, social, political, economic, material, and environmental systems in particular places. As scholars, planners, and municipal officials begin to critically consider the possibilities for meaningful forms of



participation in the “smart city,” it is perhaps useful to consider the practices of such grassroots projects and the broader processes of knowledge production and circulation in which they are involved. Do processes of participation simply include human activities within largely constrained corporate or state-led technological systems? Or do they facilitate the production of “new discourses, new practices, new artefacts” (Dillet 2017) as communities come to experiment with alternative forms of techno-sociality?

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## APPENDIX C

### Unruly Digital Subjects and the Politics of Technological Expertise

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**Abstract:** This paper interrogates the differential production of digital subjectivities—approached as the ways individuals come to understand themselves and their agency in relation to digital objects and systems. While posthuman agency may be understood as complex and emergent, the hegemonic discourses of contemporary techno-capitalism continue to privilege depoliticized conceptions of technological knowledge and re-produce hierarchies of technological expertise that are intimately entangled in the reproduction of gender, race, age, ability, sexuality, and other markers of difference. These hierarchies significantly shape the way individuals and communities come to interact with and position themselves in relation to evolving digital technologies. This paper draws on Stiegler (1998) and Barad’s (2007) work on the co-constitution of humanity and technics to explore how subjectivities are constituted differently in complex embodied entanglements with an array of agential nonhuman others. This paper offers an empirical discussion of a grassroots movement in Barcelona focused on building alternative social, political, and economic relationships to dominant technological systems. It examines the embodied practices that challenge and disrupt established digital subject positions and expectations of good “digital citizenship”, as individuals-in-collectives experiment with new modes of interacting with digital devices and systems and come to imagine and enact alternative techno-social futures.

**Keywords:** Subjectivity, Digital, Futures, Posthuman

## 1. INTRODUCTION

Within the recent “digital turn” in geography (Ash et al, 2018), a growing body of literature interrogates questions of digital subjects and subjectivities. Yet, where “digital subjectivities” (Kinsley, 2019) are discussed, they are mostly approached as a question of how digital technologies affect everyday experience or how algorithmic logics create new data-based subject positions. There has been less attention given to how individuals understand themselves in relation to digital technologies—how they experience and think of themselves as digital actors differentially positioned in hierarchies of technological agency and expertise.

This paper interrogates the discursive privileging of technological knowledge and the constitution of differentiated and hierarchized subject positions in relation to the digital. While particular subjects—overwhelmingly white, middle-class men with formal technical training—are positioned as leaders of the “digital revolution” making key decisions about the future direction of technological development, the remainder of the population is positioned as the grateful beneficiaries of innovation, anxiously awaiting the next “big thing.” More alarmingly, individuals are called upon to exercise good “digital citizenship”, understood “as an unproblematic and instrumental process of becoming an ‘effective’ citizen able to cope in a fast changing and disrupted new world of work and leisure” (Emejulu & McGregor, 2019: p. 133). While “posthuman agency” certainly exceeds such positionings (Rose, 2017), these citizenship projects work to orient embodied engagements with digital devices and systems and significantly constrain the possibilities for experimenting with alternative modes of digital development in the contemporary conjuncture.

This paper considers how hegemonic techno-capitalist subject positions and the policing of technological expertise can and must be contested to provide for alternative techno-social

futures and new forms of digital citizenship. It does so through a discussion of the practices of a social movement for “technological sovereignty” (hereafter, “TS”) in Barcelona, Spain. The TS movement is an informal network of community groups, cooperatives, and activists working to build alternative economies and institute new forms of democratic control over processes of technological change in the city (Lynch, 2019). This paper demonstrates how subjects involved in TS-related initiatives experiment with counter-hegemonic subject positions in relation to digital technologies, challenging the discursive privileging of technological knowledge and the gendered and racialized ideologies with which it is entangled. In TS initiatives, notions of technological expertise and the hierarchical division of labor are given over to a diversity of subjects as people collaborate to develop and use open-source technologies in alternative social, political, and economic projects. This contesting of boundaries between the technological and the social, political, and economic is accompanied by an attentiveness to the gendered and raced dimensions of contemporary digital technologies and an explicit focus on gender equity. I present these practices as the production of unruly digital subjects—subjects that refuse to adhere to the accepted categories and forms of authority through which good “digital citizenship” is expected to be exercised. The production of unruly digital subjectivities involves embodied practices of experimental engagement with digital technologies in ways that transgress the hegemonic subject positions of techno-capitalism and expectations of good “digital citizenship”.

This paper contributes to Elwood and Leszczynski’s (2018: p. 640) call for feminist digital geographies, exploring the “possibilities of a liberatory digital politics for re-making our technologies and ourselves as digital subjects.” It also expands on Rose’s (2017) work on differentiated “(post)human agency in the digitally-mediated city” by exploring how individuals come to understand and challenge that differentiated agency in the specific case of the TS

movement in Barcelona. In doing so, the paper builds on feminist and queer critiques of science and technology more broadly (Haraway, 1985; Barad, 2007)—challenging claims to universality and raising questions “about who speaks for technology, and concomitantly, who is spoken for by technology” (Cockayne & Richardson, 2017: p. 1588). In particular, I draw on the work of several theorists who stress the co-constitution of humanity and technics, and thus the ways subjects continually emerge differently through iterative forms of embodied interaction (or intra-action) in the world (Stiegler 1998; Barad 2007).

This paper is based on over a year of ethnographic fieldwork carried out in Barcelona between 2016 and 2018. During this time, I conducted participant observation with several community organizations involved in promoting “technological sovereignty” and at events focused on technology politics in the city. This paper draws in particular on my participant observation in a workshop series on digital political participation organized by two feminist TS activists, and in the *Ateneus de Fabricació*—a network of municipal-sponsored digital production spaces similar to a FabLab (Walter-Herrmann and Büching 2014) but organized according to an alternative political economic logic. I also interviewed 23 individuals involved in TS-related projects, and collected and analyzed various manifestos, pamphlets, flyers, and other promotional materials. All interviews and events were conducted in either Catalan or Spanish. I am fluent in both languages and all translations throughout this paper are my own.

The following section situates this paper in relation to the broader literatures on digital subjectivity in geography, examining approaches that consider the material and affective entanglement of bodies and digital systems as well as those that stress the gendering and racialization of digital technologies. I bring these approaches together through the work of Stiegler (1998), Barad (2007), and others who stress the iterative production of difference through ongoing



embodied practices in interaction with technological devices and systems. This sets up a framework for understanding the practices of TS activists in Barcelona as practices of producing unruly digital subjects. Section 3 offers an overview of the TS movement in Barcelona and the way its practices disrupt the discursive separation and privileging of the “technological” from the social. Section 4 examines the role of feminism in the movement and the production of explicitly feminist discourses and practices in TS initiatives. Section 5 considers how TS activists enact alternative subject positions in embodied and emplaced entanglements with digital technologies, experimenting with modes of being and relating to digital systems that transgress de-politicized notions of good digital citizenship.

## 2. DIGITAL SUBJECTS, DIFFERENCE, AND THE POLITICS OF TECHNOLOGICAL EXPERTISE

### 2.1 Digital Subjectivities

Reviewing recent literature in the emerging field of digital geographies, Kinsley (2019) identifies three primary approaches to the topic of digital subjectivities: the digital subject as the discretized object of surveillance, the “‘statistical doubles’ (Rouvroy & Berns, 2013) represented in data” (p. 153), and the subjective experiences mediated or produced through digital technologies. Reflecting on these contributions, Kinsley (2019, p. 154) highlights how:

We negotiate the performance of our identity through conditions of mediation, from government-issued personal identity codes to messages on WhatsApp... We assume particular forms of status or receive responsibilities, and afford those qualities to organizations that may act autonomously, from companies to ‘intelligent agents’.

This mediation is seen in the work of Cockayne and Richardson (2017) and the contributors to a special issue of *Gender, Place & Culture (GPC)* on “Queering Code/Space” examine the multiple ways digital technologies mediate experiences of urban space and the constitution of non-

normative sexual subjectivities. For instance, Miles (2017), in the same issue of *GPC*, shows how location-based dating apps like Grindr and Tinder reconfigure the way queer men experience urban space and their place in a queer community in London. In another contribution, Jenzen (2017) explores how trans youth employ creative strategies in producing and consuming social media that challenge the cis-normativity of online culture. This literature makes important contributions to our understanding of the complex entanglements between digital technologies and everyday, embodied lived experience. Yet, most of this work fails to address the question of how subjects conceive of and experience their relationship to digital systems and processes of digital innovation, production, and consumption, focusing instead on technologies as mediators of subjective experience or apparatuses of subjectification.

This recent literature on digital subjectivities has also been largely separate from earlier work—primarily from the late 1990's and early 2000's—on the production of gender, race, and class inequalities in relation to digital technologies and the emerging “information economy”. Sundin (1996), for instance, examined the gendering of technology and technological work in the case of local policy initiatives in Lindesberg, Sweden, and Holloway et al. (2000) studies the reproduction of masculinities and femininities among youth in Information Technology (IT) classrooms. Cooper (2000) highlights the production of new masculinities as a mechanism of control amongst “knowledge workers” in Silicon Valley. Meanwhile, both Park (1999) and Marez (2016) document the re-production of racial hierarchies and inequalities in the labor economy of Silicon Valley, differentiated between the “unskilled” labor in production or maintenance, and “skilled” work in the so-called “knowledge economy”. All of this work critiques the way technology and technological knowledge becomes discursively tied to masculinity and whiteness.

Such empirical accounts help demonstrate the continued effects of pervasive ideologies linking technology and “modernity” to masculinity and whiteness (Adas, 1990, 2009). While these ideologies enable inequalities in relation to access to technology, it also dramatically shapes the current and future trajectories of digital development and innovation—as ideologies of white, cisgender, heterosexual, masculinity drive new advancements in digital technology. Fancher (2016), for instance, describes how an “artificially intelligent” chatbot purportedly passed the Turing Test<sup>5</sup> through a performance of embodiment based in whiteness and teenage masculinity, while Nobel (2018) examines how racist and sexist biases are encoded into everyday digital systems, such as search engines.

These ideologies and the inequalities and abuses to which they give rise have been thoroughly critiqued by feminist, queer, and critical race scholars—among others—contesting the way technological and scientific knowledges become privileged and discursively separated from their broader social entanglements (Haraway, 1985; Barad, 2007). Technology and “technical” knowledge more broadly gets positioned as universal and singular, and thus depoliticized—made explicit in understandings of “technocracy” as de-politicized rule by “experts” (Mitchell, 2002). This privileging of technological knowledge cannot be extricated from its basis in ideologies of gendered, racialized, and heteronormative dominance, as technology becomes discursively tied to universality, rationality, masculinity, and whiteness, with its concomitant “other”—the particular, the feminine, the racialized, the queer, the emotional and social.

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<sup>5</sup> The Turing Test refers to a common way of evaluating the level of intelligence of a purportedly artificially intelligent (AI) machine. In the test, a human engages in an anonymous text-based conversation with two other actors—another human and the artificially intelligent machine. An AI is said to pass the Turing Test when the human operator is unable to reliably distinguish between the human interlocutor and the machine.

These discursive constructs play a key role in shaping broader subjectivities within contemporary techno-capitalism, constituting new regimes of power and control. In *The Birth of the Clinic* (2003), Foucault describes the formalization and institutionalization of medical knowledge and its role in constituting new subject positions and relationships of power between doctor and patient. Likewise, in *The History of Sexuality Vol. 1* (1988) he examines the role of priests as privileged subjects claiming exclusive access to God and Biblical knowledge, and thus capable to exercising multiple forms of power over congregants—shaping subjectivities through the technology of confession. In a similar way, technologists are becoming the priests and doctors of today, employing their privileged, de-politicized “expert” knowledge in the exercise of power.

## 2.2. Techno-Social Entanglements and Embodied Subjectivity

I present the actions of TS activists in Barcelona as processes of experimentation with counter-hegemonic digital subjectivities in which individuals-in-collectives explore the possibilities for alternative relationships to digital systems. To explore the potential unruliness of always-differentiated subjectivities in relation to the digital, I draw on the work of Stiegler (1998) and Barad (2007) to consider the role of embodied engagements with technology in constituting subjectivity. I present the work of TS activists as practices of reflexively experimenting with these embodied engagements and exploring the possibilities for them to become otherwise.

Stiegler (1998) intervenes in debates about the nature of human-technological relations by arguing for an understanding of an “originary technicity”—the notion that humanity has evolved over time through its interaction with the material world through technical practices. To make this argument, Stiegler follows the work of Leroi-Gourhan (1945) examining the evolution of the human species and the use of tools, showing how the human brain and skeleton both co-evolved

with technology. Such an argument undermines any conception of technical objects as “prostheses” extending a given “natural” body, instead seeing these purportedly external objects as constitutive of the human as species. For Stiegler, humans engage in the world through technical processes of interacting and shaping the world. These processes constitute simultaneous processes of exteriorization and interiorization—that is, the production of material and technical artefacts and subjectivities. Yet, Stiegler argues that this originary technicity has been “forgotten” or erased from Western thought, beginning with the devaluing of *tekne* in relation to *episteme* in the work of Aristotle. This devaluing of technics in Western discourse has led to a blindness to the complexity of human relationships to technology and the role of technics in constituting human life and subjectivity. This “originary forgetting” helps account for the de-politicization of technology and the discursive separation of technological knowledge from its broader social entanglements.

Like Stiegler, Barad’s (2007) stresses the continuous emergence of subjectivity through embodied practices of interacting (or in her vocabulary “intra-acting”) in the world in constant entanglement with an array of nonhuman others and technical apparatuses. Yet, unlike Stiegler, Barad accounts for the iterative production of difference—how subjects emerge as always differentiated and spatialized. This approach recognizes the discursive production of difference—the sorting and ordering of beings and objects into stratified categories of difference—but explores how those differences are performatively produced in practice. Differences are iteratively produced through ongoing material discursive practices of intra-acting in the world. Barad understands these material discursive practices through the figure of the apparatus. She explains: “apparatuses are *the material* conditions of possibility and impossibility of mattering; they enact what matters and what is excluded from mattering. Apparatuses enact agential cuts that produce

determinate boundaries and properties of ‘entities’ within phenomena, where ‘phenomena’ are the ontological inseparability of agentially intra-acting components” (Barad 2007, p. 148). Subjectivity is thus a question of locating oneself in the world, if only ever partially and momentarily—of conceiving of and experimenting with one’s spatially-situated, embodied, material entanglement at the intersection of multiple evolving apparatuses.

Barad thus posits the possibilities for production of ethical subjects through modes of embodied and emplaced intra-action. She writes: “Subjectivity is not a matter of individuality but a relation of responsibility to the other. Crucially, then, the ethical subject is not the disembodied rational subject of traditional ethics but rather an embodied sensibility, which responds to its proximal relationship to the other through a mode of wonderment that is antecedent to consciousness” (Barad 2007, p. 391). In exploring the actions of TS activists in Barcelona, I pay attention to the forms of embodied sensibility and relationships of proximity as subjects reflexively experiment with different modes of intra-acting in relation to digital technologies. I highlight how these practices produce new experiences that draw attention to and re-orient embodied relations to digital technologies and open possibilities for imagining and exploring alternative, more ethical—possibilities for intra-acting and thus producing the emerging techno-social future.

In discussing the production of unruly digital subjects in the case of the TS movement in Barcelona, I build on recent work across disciplines exploring possibilities for alternative techno-social futures. Emejulu and McGregor (2019) call for digital education based on notions of praxis-based “radical digital citizenship” in which “individuals and groups: (1) critically analyse the social, political, economic and environmental consequences of technologies in everyday life; (2) collectively deliberate and take action to build alternative and emancipatory technologies and technological practices” (p. 131). The authors argue for the need for new educational practices that

help students to understand their complex entanglements in technological systems and to “debunk magical thinking whereby the ‘digital’ is invoked as a fetish” (ibid., p. 132). Yet, this work lacks a deeper engagement with the production of the differential modes of embodiment through which subjects encounter and engage digital technologies.

In contrast, Weheliye (2005) highlights the importance of embodied differences in his accounts of the role of sound technologies in the active production of black cultural identity and subjectivities in the US—positioning racialized subjects as technological actors experimenting with alternative ways of being in relation to technological objects and systems. Similarly, Marez (2016) describes Mexican farmworkers and activists in California as embodied technological actors experimenting with new media technologies in organizing for labor rights and coordinating broad solidarity networks. He contrasts this depiction with the practices designed to erase and obscure the technological agency of racialized subjects—de-valuing the technical skills they employ in using, maintaining, and repairing complex agricultural machinery and subjecting their bodies to technical assemblages of surveillance and control. More specifically, in the case of Barcelona, Egaña and Solá (2016) explore artistic practice in the local transfeminist movement and its relationship to hacker and open-software movements. They highlight “how the technological is, together with the body, a space from which to transform reality” (Egaña & Solá, 2016: p. 80), drawing connections between calls for technological sovereignty and bodily sovereignty and their entanglement in experiments with new forms of subjectivity.

To explore the production of unruly digital subjects in Barcelona, I first consider how the practices of TS actors work to disrupt the discursive separation of the technological from the social—that is, the way they draw attention to and reflect on the intimate, constitutive relations between technicity and sociality. I then consider how they draw attention to the differentiation and

hierarchization of subject positions in relation to “technological” knowledge. The final section examines the embodied practices through which TS actors reflexively experiment with alternative modes of relating to digital devices and systems and come to project alternative techno-social futures.

### 3. TECHNOLOGICAL SOVEREIGNTY: SUBJECTIFICATION BEYOND THE TECHNO-SOCIAL BINARY

The movement for technological sovereignty in Barcelona is an informal network of community initiatives, cooperatives, and activists experimenting with the production and use of open-source technologies in order to claim greater community control over processes of technological development and change in everyday life. TS-related initiatives include projects like Guifinet, The Things Network, and CommonsCloud focused on developing common digital infrastructures; a growing list of local technology cooperatives offering digital services on the local market; and groups organizing events and spaces for collective theorizing and organizing like the annual Technological Sovereignty Congress (SobTec) or the Mobile Social Congress (MSC). The movement is extensively networked with multiple political and social struggles in the city—over digital inclusion, local democracy, labor rights, gender equality, and economic justice.

The movement is composed of a broad diversity of individuals from a variety of backgrounds not typically represented in the mainstream technology sector. These backgrounds are representative of the ways TS activists contest the techno-social binary and seek to disrupt dominant hierarchies of technological expertise. On the one hand, some actors come to the movement from a formal background in computer science or engineering, which they come understand in a broader social or political consciousness. For instance, as the founder of a local



programming cooperative explains: “I studied computer science and then worked in the corporate technology sector, but couldn’t do it any longer for ethical reasons. I had always seen my politics and my work in technology as separate, but I started to see how my work was contributing to exploitation, to war, to things that go against my political and ethical beliefs” (interview, 18 January 2018). Others with formal technical training expressed similar sentiments, recognizing that their “technological” education failed to prepare them to recognize and think through the social and political implications of their work. Over time, many of them came to recognize and reflect on their broader entanglements in the world and imagine new kinds of technological practice.

Others come from less “techie” backgrounds and more directly challenge the politics of technological expertise. For instance, TS activist Nuria studied Fine Arts before becoming involved in local autonomous hacker spaces in the 1990’s, through which she learned about web design, server maintenance, and other skills. She explains: “I could have studied some technical skill at the Polytechnic, but that wouldn’t mean it would be useful for the work I do. I’ve learned to use and develop the technologies that I’ve needed in different moments for particular social and political projects” (interview, 21 March 2018). For Nuria, her interest in digital technology stems from the possibilities it offers for social and political change.

Another activist, Montse, was trained in social psychology and worked as a social worker before facing prolonged unemployment following the 2008 financial crisis. Inspired by her participation in a local renewable energy cooperative, she decided to help start a small telecommunications cooperative, despite an admitted lack of formal technical knowledge or training. She explains that in starting the cooperative, she reflected on the growing importance of digital technologies and infrastructures in everyday life and her own political concerns with the corporate monopoly: “From my participation with SomEnergia [energy cooperative], I started to

think about the other systems we depend on and how they are managed. Here in Barcelona, we have a big problem with telecommunication companies, so we wanted to find a way to take back collective control” (interview 15 August 2016). All of these examples point to the way particular subjects came to reflect on their own practices and the everyday entanglements of technology with social and political life—experiences that challenged, for them, the discursive separation and de-politicization of a fetishized realm of “technology.”

This diversity of backgrounds is reflected in ongoing processes of debate and discussion through which TS actors challenge traditional divides and discursive boundaries. Many of the TS initiatives work to promote critical collective debate around the direction of technological change and cultivate new relationships with digital technologies, both amongst themselves and within the communities in which they are embedded. Internal meetings of TS collectives often involve active debate and discussion about particular corporate technologies and the possibilities, limitations, or desirability of progressive alternatives—as TS activists continually challenge their own understanding and expectations of digital objects and systems. For instance, in regular meetings of the SobTec organizing committee, participants frequently discussed particular technologies, debating the social and political implications of gamification<sup>6</sup> or artificial intelligence, and the potential or not of progressive and radical uses. As a space from which to collectively theorize “technological sovereignty” as an organizing concept, the SocTec organizing group also serves a space of collective reflection and subject formation. Participants de-construct and challenge the de-politicization of technology and their own relationships to it.

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<sup>6</sup> “Gamification” refers to the integration of elements of gaming (competition, rewards, etc.) into digital systems, such as the “Like” button on Facebook. Gamification works as a way to enhance “user experience” and encourage particular forms of engagement—maximizing time spent on a website or application, or producing specific kinds of data to be exploited (Zichermann and Cunningham 2011).

Other activities are focused outward toward the broader community. For instance, Lleialtec is a project focused on installing and maintaining open-source systems in autonomous and municipal community spaces. As one of the project leaders explains: “the consciousness of the citizenry is the objective. The open-source infrastructure of the building is the example, but not the objective” (personal interview, 3 May 2018). The group wants to bring open-source infrastructures into the spaces of everyday life in the city—sites where neighbors meet for local theatre productions, book clubs, continuing education classes, or to organize community events. La Lleialtec aims to integrate critical conversations about technology into these spaces in order to raise consciousness among the public about the abuses of the current hegemonic model and the possibilities for alternatives; “We think that at least people should understand where their data are—if they are in their PC or in their phone, or if they are in the cloud... What is the cloud? What is a client server?” (Ibid.). Working with the local theatre group, the initiative plans to develop a series of short skits exploring the entanglement of digital technologies in everyday life and its effects. Activists reshape the technological infrastructures of the neighborhood, while also creating new opportunities for neighbors to reflect on their own relationships to capitalist digital systems. Such an approach recognizes everyday, embodied interactions as key to the re-production of particular kinds of relations and subjectivities.

Other initiatives like SobTec and the Mobile Social Congress create public events where members of the local community come to learn about the social, political, and economic impacts of corporate technology and about the alternative projects being developed locally in Barcelona. As one of the MSC organizers explains: “We want to create a space for critical reflection with the citizenry and the entities and cooperatives that are working on these topics... and create a space to show that there are alternatives that are being built... that we are in this process of collective

construction” (personal interview, 15 March 2018). The MSC, in particular, aims to draw attention to aspects of the tech economy that are erased from mainstream discourses and representations.

Such events offer spaces for networking and coordination across initiatives as well as an opportunity to engage a broader public. Promoting a critical consciousness in the broader public is seen as key to TS initiatives. TS activist, Nuria, explains “private technology offers easy solutions for the fast consumption of technology” that TS initiatives are not able to compete with in terms of cost or convenience (personal interview, 21 March 2018). Convincing people to invest time and energy into alternative technologies requires building a social and political consciousness.

Both the municipal 3D printing labs, *Ateneus de Fabricació*, and the technology/social work cooperative, *Colectic*, offer courses and training programs allowing local youth and others to gain digital skills and knowledge about the social and political dimensions of corporate technologies and open-source alternatives. Jordi Reynes, the director of the *Ateneus de Fabricació*, explains that the objectives of the municipal initiative are three-fold: socio-economic, territorial, and educational. By making advanced digital production technology available to the broader public—in a similar way to a public library—the initiative aims to facilitate experimentation with new local economic activities and livelihood strategies, support the well-being of neighborhoods and local communities, and allow individuals to develop new skills and capabilities (field notes, 25 July 2016). Across these examples, the goal of engaging a broader public beyond those already involved in TS initiatives and the focus on integrating basic digital skills and knowledge with a critical understanding of technology’s social, political, and economic entanglements demonstrate what Emejulu and McGregor (2019) call a “radical digital citizenship”. Such an approach challenges the discursive privileging of technological “expertise” and aims to create spaces for broader critical discussions about digital technology among a diversity of subjects.

#### 4. TECHNOLOGICAL SOVEREIGNTY AND THE POLITICS OF DIFFERENCE

In addition to challenging the discursive privileging of technological knowledge and policing of technological expertise, the activities and critical discourses developed within the TS movement seek to challenge the related gendering and racialization of technology. It is important to recognize that gendered and racialized ideologies do not disappear in the TS movement and I do not mean to present the movement as one of perfect gender and racial harmony. Rather, I focus on the ways these issues are highlighted and made visible in the TS movement and the ways digital technology becomes a site through which critical discussions about gender and race take place. The level of engagement with feminist critiques and energy devoted to addressing gender inequality vary across the initiatives and collectives that make up the movement. Some initiatives continue to be predominately male, while others strive for gender parity, and others still are run exclusively by women. Yet, across these differences, I highlight the ongoing practices that work to actively disrupt the deeply engrained gendering of technology. While questions of *gender* are addressed much more directly in the movement and therefore are given more attention here, I also highlight particular sites and practices that explicitly address questions of *race* as well.

Many TS activists recognize the link between diverse gender representation in projects and initiatives and the re-embedding of technology in its broader social entanglements—discussed above. Sam, for instance, explains: “In environments where it is all men, it is technology for technology’s sake. It’s more ‘geek’. It’s ‘hey let’s try this’ just because we can and it doesn’t have any political or social component” (personal interview, 3 May 2018). Reflecting on the case of Pam a Pam, a project building a digital database and map of social economy enterprises in Catalonia, Laia explains:

In the group, there are people who aren't 'techie' and we need to break the logic of 'you need to know how to code to be there'... Pam-a-Pam is a very feminized project, given that consumption is heavily feminized. The project has always been carried out by women technicians. We've never had a male technician. And it is noticeable in the way things work, the attention to care. The technicians spend a lot of time making sure the process is participatory, that it is a welcoming space where people feel like they can participate (personal interview 18 May 2018).

At the most basic level, TS activists work to make visible gendered inequalities in relation to digital technology. It is not uncommon for meetings between different initiatives or collectives to continue to be primarily—or on some occasions even exclusively—male. Yet, within the movement it is common to draw attention to this and critically reflect on its causes and implications. Both the Mobile Social Congress and SobTec have featured speakers reflecting explicitly on issues of gender representation in the technology sector, while the organizing committee of SobTec keeps track of the gendered participation at the annual conference and highlight the continued inequalities. Guifinet is a project with a far lower level of women participants, but the question of gender inequality is often raised at gatherings and on digital forums as participants attempt to reflect on the causes and consequences of this.

In re-embedding technology and digital labor in its broader social entanglements, the TS movement also involves processes of reconstituting traditional forms of masculinity common in tech work. For instance, Joan explains his decision to leave his previous job as a programmer in a private tech company to start a small cooperative with a friend. "We both have kids, and it was 'leave the house at 8 and get home at 7'... and now, I mean sometimes I work some strange hours, but I can take my kids to school and talk to their teacher, and all of that. I can really contribute more to my family responsibilities" (personal interview 29 January 2018). In addition to drawing attention to the lived realities of digital work and labor, Joan's explanation stands out for its

contrast to accounts of hyper-masculinity and productivity in the techno-capitalist economy (Cooper, 2000).

While given less attention than gender, several TS initiatives and practices also draw attention to the racialization of digital technology in contemporary techno-capitalism. Alencop, for instance, is a workers' cooperative of sub-Saharan African migrants working in e-waste recycling and disposal in Barcelona (Lepawsky et al 2017). The cooperative was formed in 2015 after a community of migrants were displaced from an old industrial warehouse they occupied in the neighborhood of Poblenou to make room for a redevelopment project. They formed the cooperative, composed of 25 members from 9 countries, with the help of the municipal government and the local neighborhood association. They get called to pick up old electronic devices and appliances, which they collect from people's houses and transport with electric tricycles with moving containers attached to the back. In addition to home collections, they help empty old industrial spaces, organizing transport and recycling logistics. Beyond this, they work to educate the community by giving talks and workshops at community centers about reusing and recycling and are in the process of expanding their activities to include the more "skilled" work involved in the repair and reuse of devices. They also hope to offer spaces for self-repair, where people can come and use tools, the space, and get help and advice on repairing their own appliances and electronics. The cooperative's current activities and future ambitions aim to create a role for themselves in the production of more responsible relationships to technological devices. Challenging the racialization of technology, they are leading processes of techno-social change through their community outreach and advocacy work around reuse and recycling, and by developing their own capabilities to work and appropriate devices in new ways.

## 5. UNRULY DIGITAL SUBJECTS

This section focuses on the various practices through which TS actors in Barcelona work to produce new subject positions in relation to digital technology. I offer two vignettes from my participant observation in Barcelona to demonstrate the embodied and material processes of subject formation in the TS community—practices that re-socialize technological knowledge and challenge the politics of expertise. These vignettes highlight the ways differentiated digital subjects come to re-think their embodied-material relationships with digital technologies and infrastructures through active practices.

### 5.1 Ateneus de Fabricació

Throughout the fall of 2017, I regularly observed events and meetings at the *Ateneu de Fabricació* (AdF) in the Ciutat Meridiana neighborhood of Barcelona. The Ateneus are digital production spaces—similar to a fab lab (Walter-Hermann and Büching 2014)—owned and managed by the municipal government and organized according to cooperativist logics. In the name of the spaces, the term “ateneu” comes from the name for autonomous, community education spaces that acted as important hubs of activity and consciousness-raising in the city’s worker movements in the late 19<sup>th</sup> and early 20<sup>th</sup> century (Ealham 2005). The space’s founding director explains that the name is meant to signal a different model of learning beyond the narrow logic of acquiring skills for the knowledge economy. The spaces are designed to democratize access to advanced digital technologies and technological knowledge, similar to the way ateneus worked historically to democratize education to create worker autonomy. Reshaping subjectivities in relation to digital technology is one of the primary goals of AdF. Its mission is for “people to take ownership over new technologies” and to create a space for “reflection, experimentation, debate,



training, and advising for all who want it” (AdF Ciutat Meridiana website, accessed 28 January 2019). Jordi explains that “If don’t radically democratize this 4<sup>th</sup> industrial revolution and we leave it solely to the capitalists, it will only bring more inequality and injustice, just like all the previous technological revolutions” (interview 26 June 2016). This position is based on a deep reflection on the past several decades of rapid digital change, in which those with access to emerging technologies and the education and privileges needed to participate in the information economy have benefited from new technologies, while others have seen themselves subjected to intensified processes of exploitation and exclusion.

Ciutat Meridana is one of the poorest neighborhoods in the city with a large immigrant population, carved into a steep valley in the Collserola mountain range on the far edge of the city. Hastily built in the last years of the Franco dictatorship, the neighborhood long lacked basic services and infrastructures. Yet, the AdF in Ciutat Meridiana was one of the first and the largest in the city. The AdF in Ciutat Meridiana consists of two floors and is equipped with laptop computers, multiple models of 3D printers—from the most basic models to advance resin-based printers—a large automated saw capable of printing large furniture, and a laser cutter—among other digital production machines. The space is staffed by two technologists as well as two community organizers and a director, and neighborhood residents have open and free access to the space based on the system of *contraprestacions*—or contributions—in which each person making use of the facility should give back in some way through service to the community.

While at the AdF, I observed a local feminist collective use the facilities to produce materials for an anti-domestic violence campaign in the neighborhood, using advanced design software and automated laser-cutters. I observed workshops for children who learned to design and print their own toys and for community groups to design and print decorations for the neighborhood festival.

The AdF also regularly hosts community events with guest speakers or workshop facilitators, creating opportunities for neighborhood residents to come learn about emerging technologies like augmented reality and 3D scanning.

During my participant observation, I regularly observed a group of teenagers who came to the AdF twice a week as part of a program to learn about advanced digital production technology. The group is part of a program known as the “breakers”—a term used to refer to the “maker” movement but with a focus on breaking stereotypes about who can be a maker and what the movement is about. The group consisted of 10-12 members in their late teens, from a mix of national and ethnic backgrounds. While a few of the members identified as Catalan or Spanish, the rest came from immigrant families from Ecuador, El Salvador, Bolivia, Cameroon, and Senegal. Two of the members were women.

In one of their first projects, the group facilitator, Patricia, taught the participants to use 3D modelling and design software to create a design for a model car that they would then print in pieces using the laser cutter. While the students worked on computers learning the basic functions of the software, the participants were anxious to get to use the 3D printers. When their designs were completed, they took turns printing them with the laser cutter. As they each stepped up to print their designs, they were visibly excited to watch their designs and ideas materialize in front of them. These moments make visible for the participants their embodied and material entanglement with digital systems. As one participant expressed: “It is really cool. I designed it and now it’s real. I can touch it.” Such comments highlight the way engaging digital production technologies like 3D printers in the AdF works to re-orient embodied dispositions and encourage individuals to experiment with different modes of engaging digital technologies.

Yet, significantly, in the AdF the experience of materializing one's ideas using advanced digital technology is always re-embedded in the material and spatial relations of the surrounding neighborhood and social needs of the local community. In contrast to discourses of entrepreneurship and "disruption" common in most mainstream fab labs, the AdF staff stress the potential for these technologies to transform local social relations along cooperativist lines and re-imagine alternative techno-social futures. On one of the first days of the program, Patricia leads the group in a discussion exercise, introducing them to a vocabulary for thinking about the AdF and the kinds of activities they carry out. She asks the group to reflect on terms like DIY, Arduino, Open Source, Ateneu, Maker, and Future. The exercise blended together technical terms like Arduino—an open-source micro-controller that can be used to run a range of sensors, motors, or other automated functions—with terms related to their broader political and social entanglements. In discussing the term "future," Patricia encourages the participants to think critically about what kind of future they want to see, not just for themselves, but for their families and communities. As one AdF staff member told me: "I don't know exactly what a just technological future looks like, but I think we need to create opportunities to reflect on it collectively" (fieldnotes, 7 November 2017). This highlights the way processes of subjectification are not individual affairs. Producing unruly digital subjects also requires the production of new ways of being and imagining in community with others.

As part of the Breakers initiative the group must work together to design and build something that meets a social need in the local community. Following the reflection exercise, Patricia tells the participants to look around them as they walk home and go about their lives the next few days, to think about the social needs they might see around them. How might they use the technologies in the AdF to address these needs? The facilitator's invocation to think critically about the social

relationships and problems around them and reflect on possibilities for addressing them stands in contrast to more common accounts of “citizen participation” in smart city projects. For instance, in Wilson’s (2011) account of participatory geocoding projects, participants are trained to identify and geo-code derelict sites in their communities, objectifying and encoding people and spaces deemed of interest for governmental intervention. Rather than objectifying sites and people deemed to be problems, Patricia encourages the participants to think about their own social entanglements and needs in the neighborhood and how they might make use of the digital production technologies at their disposal to address them.

Perhaps the best example of the production of differentiated unruly digital subjectivities in the AdF is the experience of Manuel. Manuel is 20 years old. Originally from Ecuador, he came to Spain when he was six years old. He spent most of his teen years in a youth home in Terrassa—an industrial city in the Barcelona metro area—after being kicked out of his home for being gay. Manuel participated in a Breakers group in the summer of 2017, and then continued coming regularly to the AdF to work on community projects and use the facilities. He was now assisting Patricia in facilitating the Breakers workshops. When I met him, he had recently designed and printed a custom table for a disabled student at the elementary school next to the AdF. He told me that he had always been interested in technology, but being more effeminate, he never felt comfortable in any other tech-related programs which he says are always very “macho.” He likes coming to the AdF because a lot of the staff are women. While most of the Breakers participants are young men, he has become close friends with some of the few women participants in the past programs, and overall the environment is more welcoming. Manuel explains that at the AdF he has been able to work on teams with people to address local social needs, which has allowed him to

feel like part of a community and to be able to imagine a future for himself using technology for social good.

## 5.2 Digital Political Participation Workshop

In February 2018, I participated in a course on digital political participation sponsored by the municipal government and led by two prominent TS activists, Irene and Montse, both members of local technology cooperatives. The course took place in a local community center and was a total of twelve hours held on Friday evenings and Saturday mornings over two weeks. It was designed for leaders of local neighborhood associations, community movements, or cooperatives with limited prior engagement in questions of digital technology. The goal of the workshop was to give these people some basic tools to use and engage digital technologies effectively in their political practices while understanding its broader social, political, and economic impacts.

There were 10 participants in the course, including myself, evenly split between men and women. In the first session, we each took turns introducing ourselves and explaining what drew us to the course. The group included two women from a local cooperative consultancy group—offering legal, financial, and labor advice to social economy initiatives across the city—who are also involved in grassroots projects focused on deepening local democracy in their neighborhood in L'Hospitalet de Llobregat, on the outskirts of Barcelona. Other attendees included a member of a local mobility cooperative in a small city north of Barcelona, a grassroots organizer linked to a left-wing political party, and representatives from several neighborhoods associations from across the city.

In the introductions, all of the participants explained that they had little previous knowledge in how digital technology works beyond their everyday use of email, google services, Whatsapp,

etc. They introduced themselves clearly as “users” of digital technology with little knowledge of the “technical aspects” of how it all works. Several people mentioned some frustration or concern about privacy and surveillance, given recent public scandals involving Facebook or attempts by the Spanish state to shut down websites and monitor online speech surrounding the contested 2017 Catalan independence referendum, but recognized that they did not fully understand how it all works.

Over the four meetings of the course, Irene and Montse led us through a series of activities and critical conversations designed to introduce us to basic concepts in networked technology, allow us to reflect on how they work and our relationships to them, and to learn about existing and emerging alternatives based around the notion of technological sovereignty. Several of the activities in particular, sought to highlight the materiality and spatiality of the digital infrastructures on which we increasingly rely and to reflect on who owns, maintains and has access to them.

We started the workshop with Irene leading an activity about internet infrastructure. We all formed a circle in the room and Irene gave us each a card from a deck. Each card had a piece of internet infrastructure on it—i.e. computer, router, server, etc. She found the person with a computer and asked us: if she wants to send an email where does that email have to pass to reach another person’s computer? One by one we went through organizing the cards based on the steps connecting one computer to another: from a computer to a wifi adapter, to a router, to the cables and servers of the Internet Service Provider, to a national network, to another ISP’s infrastructure, to the receiver’s router, wifi adapter, and computer.

This exercise made visible the extensive infrastructure on which we rely for the internet and to which we trust our personal data; the exercise brings to consciousness the vast and expanding “technological unconscious” (Thrift, 2004). Irene then asked us where in this system our data is

vulnerable to interception? We discussed what kind of data might be transmitted in a simple email and who may be able to access it through any given point in the material infrastructure. While we discussed the possibility for different kinds of encryption, we came to agree that data may be vulnerable at any of those steps depending on the situation. The data could be accessed by internet service providers, by government institutions, and by hackers and put to different uses. This activity helps re-orient embodied sensibilities toward an awareness of and concern for the complex digital infrastructures on which daily lives and livelihoods increasingly depend.

Next, we did a similar exercise in pairs where each pair chose a digital service and traced the data that was sent through the service, where it went, and when and how it might be vulnerable to surveillance/interception. I paired with a local neighborhood association leader. We chose Whatsapp and went through the different data points and where in the infrastructure they might be vulnerable. We then collected basic information about WhatsApp and compared it to similar services like Viber, Telegram, Signal, and other messaging and voice applications. We sought to answer questions like “who knows the service?”, “where is the company or group based?”, “is the app based on open-source code?”

After the pair exercise, we came together as a group to reflect on who uses our data and who is able to make a profit from it. We talked about how data is used to produce profit for technology companies and how it is able to build profiles about us as individuals and our connections to others. Many people in the group were angry when they thought about how their personal data is being exploited and often even shocked to learn exactly how the internet and most tech companies operate. As one woman proclaimed: “ignorance is bliss”. The woman later told me that she felt that she learned a lot through the course. She had previously thought of digital technologies as tools for carrying out her political work but had never thought of her relationship

to technology itself as political. The activities that made up the workshop helped to disrupt the re-iterative re-production of certain embodied engagements with digital technologies and systems and offer participants opportunities to imagine and experiment with alternative practices.

## 6. CONCLUSION

This paper has explored the question of digital subjectivity—understood as the way individuals understand and experience their relationship to digital technologies. Contemporary techno-capitalism relies on the division and stratification of digital subjects according to perceived levels of technological expertise and agency that are intimately entangled in the reproduction of gendered and racial difference. These differences and re-iteratively reproduced through everyday embodied practices of engaging and employing digital devices and systems in particular ways. Through repetition, these practices come to be taken-for-granted. This works to de-politicize technology and processes of technological development. I have examined the case of the movement for technological sovereignty in Barcelona as an example of practices producing unruly digital subjects—material and embodied enactments through which individuals come to challenge established notions of technological expertise and experiment with alternative relationships to digital technologies and systems.

In exploring these themes, this paper makes three primary contributions to the emerging literature in digital geography. First, I move beyond existing scholarship on digital subjectivities in which technology is examined primarily as a mediator of subjective experience to raise the question of how subjects differentially experience their relationship to digital technology and processes of technological development and change. Second, I offer a theoretical framework to integrate recent scholarship on the material and affective relationships to technology with work on



the way the “technical” gets discursively tied to modernity, whiteness, and cis-hetero-masculinity, and thus de-politicized. Third, through the empirical discussion of the TS movement in Barcelona, I offer examples of the kinds of practices through which activists experiment with alternative political, economic, and social relationships to technology—simultaneously challenging the discursive separation of the technical from the social and the related gendered and racialized hierarchies.

These contributions point toward a series of future areas for digital geographic inquiry. Further research is needed into the daily practices through which dominant techno-capitalist subjectivities are reproduced, including the ways the technical practices and agency of women, queers, and POC gets discursively erased from dominant narratives and representations. Work is also needed to understand the cultural production of Silicon Valley and the way the capitalist tech industry monopolizes visions of the future, re-enforcing its image as *the* driver of technological change. Finally, digital geographers might diversify the actors and spaces they research as the primary sites of digital development to give voice to the counter-hegemonic technological practices of feminist, anti-racist, and anti-colonial collectives from around the world.

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