Silicon Forest and Server Farms: The (Urban) Nature of Digital Capitalism in the Pacific Northwest

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Introduction

> Nature builds no machines, no locomotives, railways, electric telegraphs, self-acting mules etc. These are products of human industry; natural material transformed into organs of the human will over nature, or of human participation in nature. They are organs of the human brain, created by the human hand; the power of knowledge, objectified. The development of fixed capital indicates to what degree general social knowledge has become a direct force of production, and to what degree, hence, the conditions of the process of social life itself have come under the control of the general intellect and been transformed in accordance with it. To what degree the powers of social production have been produced, not only in the form of knowledge, but as immediate organs of social practice, of the real life process. (Marx, 1973: 706)

Access to inexpensive hydro-resources, such as hydro-electricity and water for cooling, cheap land, and proximity to undersea networks have created a spatial sweet spot for big tech companies such as Google, Apple, Facebook, Microsoft, and Amazon in the Pacific Northwest. These factors are leveraged as 'natural' reasons for the growth of the data center industry in the region, often accompanied by promises of new jobs and a rhetoric of economic transition from forestry to data. In reality, broader social and environmental implications are neglected in deference to companies that sell visions of big-data-driven economic growth for local communities devastated by crises of capital. Allusions to resource economies and ecological metaphors paint data centers as a natural evolution in resource economies while maintaining a veneer of environmentally sustainable development. While data centers do offer some moderate benefits for local communities, they also facilitate the uneven development of digital capitalism by providing the

storage and processing power for data extractivism. In this essay, we argue that the growth in data infrastructures (fixed capital) is driven by the central features of an uneven development of digital capitalism wherein the appropriation of nature, and as Marx refers to in the epigraph from the influential Fragment on Machines, social knowledge, are forces of production for the accumulation of capital.

We advance this argument in three parts. First, we argue 'nature' is produced and mobilized by large firms in their site selection and construction of data centers and data infrastructures. In short, nature is reduced to the nature that digital capital finds useful: cheap energy, cheap water, cheap land, and green imagery. Second, we argue this production of nature is at once a production of fixed capital representative of digital capitalism (data centers, fiberoptic cables, etc.). We describe this process as a 'layering' of infrastructures. Third, we argue these processes are linked to urbanization and cognitive dispossession as a generalized strategy of accumulation. We show how digital capitalism is tethered to urbanization, or what Scott (2011b) calls 'third-wave urbanization'. Urbanization here refers to the actual unfolding of physical infrastructure in the secondary circuit of capital (Harvey, 2006) *and* the 'urbanization of the general intellect' (Merrifield, 2012, 2013) which creates the conditions for data extractivism and cognitive dispossession (Negri, 2018; Wyly & Dhillon, 2018). Capital accumulation is dependent on both building a data infrastructure (to sink capital and avert crises) and exchanging, surveilling, and/or abstracting events and statuses to extract data (to produce profits through service provision, advertising, selling data profiles, etc.).

The Nature of Digital Capitalism

Our visions of nature in turn shape how we know nature. Classically, Smith takes this vantage to argue for inquiry into 'how we produce nature and who controls this production of nature' (2010: 89). For Moore (2015), like Smith, capitalism is a way of organizing human and nonhuman nature, requiring focus on modes of accumulation that position capitalism-in-nature. But what kinds of unique signatures does digital-capitalism-in-nature reveal? John Durham Peters (2015: 3) offers insights through examples like the ozone layer and arctic ice, understood as 'infrastructures of data and control' through their coverage and circulation in discourse and media. Is this the kind of 'nature' digital capitalism produces?

If we look to places like The Dalles, Oregon, we can see how Google benefits from cheap electricity and water for cooling its data centers (the first one ever built by Google in 2006 is here as well). Google wasn't the first to be drawn to The Dalles for the benefits of the Columbia River. As an editorial in Portland's Willamette Week describes: 'Columbia River hydro riches are priceless. They've drawn people to The Dalles for generations, from the first indigenous tribes to the French fur traders who named this place to today's corporate titans who have fought to profit from the region's inexpensive hydropower. Now it's Google's turn'.[1]

As Google, Apple, Facebook, Microsoft, and Amazon benefit from 'natural' advantages of the Pacific Northwest, they are often described as the next evolution of the rural economy: from timber to aluminum to data. Data centers are cast in a story of rural economic boom (and busts). When the aluminum smelters in the region closed, The Dalles and surrounding rural communities were devastated by unemployment. Twenty years later, Google's data center operation directly employs 200 in the region,[2] mostly related to security or engineering (half of which are contractors). In a symbolic allusion to the transition of The Dalles rural economy, Google purchased 74 acres from Northwest Aluminum in 2016 for future data center expansion.[3]

The methods and techniques used by 'site selection managers' of companies like Google, Apple, Facebook, Microsoft, and Amazon abstracts hydropower, water for cooling, resilience to natural hazards, and land as economically significant 'natural' factors for locating data centers.[4] This process of abstraction and commodification isn't surprising given how the economy conceives of land, labor, and money as 'factors of production' in which 'these fundamental bases of social life' are treated 'as if they were ordinary commodities' subject to market exchange (Fraser, 2014: 543). Even further, domination and hierarchy are core to these processes of fictitious commodification (Fraser, 2014).

The history of cheap energy in the Pacific Northwest is particularly illustrative. Visions of human control over nature carried a distinctly 'powerful' vision throughout the 1920s, an electrified vision that built upon the previous era's erasure and forced migration of Native American populations from the banks of the Columbia River, their ancestral lands and fishing grounds (White, 1995). Two massive dams, the Bonneville and Grand Coulee, were planned to produce more energy than all the large electric utilities in the region combined. A 'gospel of hydro' fueled economic development and shaped regional

imaginaries. In the 1940s, the Bonneville Power Authority (BPA) – the dominant regional power authority and federal electricity marketer – hired Woody Guthrie to create a promotional album. In 'Ballad of the Great Grand Coulee', he sings, 'Uncle Sam took up the challenge in the year of 'thirty-three, For the farmer and the factory and all of you and me, He said, Roll along, Columbia, you can ramble to the sea, But river, while you're rambling, you can do some work for me'.

As electricity infrastructures were developed, nature was put to work for capital. The Columbia River basin was reorganized by a series of 14 dams (3 in Canada, 11 in the US), techno-natural projects that coincided with the cultural politics of nature and nation. The broader Columbia Basin grew dramatically. During the second World War, almost 200,000 people migrated to work in ship and plane manufacturing, at military bases, in aluminum processing, and the timber industry in Oregon alone (OED 2009). Controlling the river became a project that enlisted experts, engineers, politicians and bureaucrats fueling the hopes of American Dreams, made possible by profligate use of energy. Cheap electricity became a defining characteristic of the region, supporting high energy industries such as aluminum smelting.

In places like Prineville, Oregon, where Facebook and Apple have 'rescued' a town devastated by unemployment, a narrative of economic recovery resembles Google's role in The Dalles. But cheap hydropower and water aren't what's attractive about Prineville. Temperate climate, favorable local utility contracts, and enormous tax breaks are significant, yet often overlooked, factors.[5] Nature is evoked to portray the data center industry as part of sustainable rural economic development. For example, Apple's commitments to clean energy, energy efficiency, and resource conservation expounded in their Environmental Responsibility Reports are lauded as 'greening' the internet.[6] Yet, these ecological maneuvers are driven by (unsustainable) capitalist logics. As Caraway (2017:12-15) observes 'Apple's rhetoric of responsible management of natural resources masks the capitalist drive toward enclosure'. Apple justifies the energy intensity of manufacturing and data centers by using renewable energy, positioning renewable and non-renewable as a simplistic green, sustainable and non-green, unsustainable binary while ignoring the continuously re-versioned products which necessitate an intensive manufacturing process and data center needs in its march toward profit.

This is not exclusive to Apple, as Amazon, Google, and Facebook have similarly appropriated green discourse and

greening strategies for their manufacturing, data centers, and other energy and resource intensive operations.[7] Each of these large firms, centered in the tech firms of Silicon Valley and Seattle, reach toward and rely on the natures of rural Oregon and Washington (among other places) for their continued profit successes. Digital capitalism, with all its focus on the internet, clouds, immaterial and cognitive production, is actually intensely material and has significant environmental implications (Cubitt, 2016; Gabrys, 2011; Gregg, 2015; Hogan, 2015; Mahmoudi & Levenda, 2016; Starosielski & Walker, 2016). Digital capitalism, in short, is producing new forms of technonature.

Layering Technonature

> 'The Infrastructure Layer is the data center building and the equipment and systems that keep it running. Components like back-up power equipment, the HVAC system, and fire suppression equipment are all part of the Infrastructure Layer. These devices and systems help protect servers and ultimately your data.' (Amazon Web Services)[8]

It seems easy to connect dams to nature. Dams interrupt flows of rivers for irrigation, flood control, navigation, and power production. But we know dams are not just social, technical, or ecological. They are all of these at once. In other words, dams are technonatural. They are a part of a 'socio-physical process of *producing new technonatures*, through which symbolic formations are forged, social groups enrolled, and natural processes and 'things' entangled and maintained' (Swyngedouw, 2007: 10).

New computational infrastructures build from, and on top of, existing material and physical infrastructures. On the one hand, this might seem counterintuitive because visions of data conjure images of ethereal and immaterial cyberspace. On the other hand, although data are intangible, data require storage and communication, which necessitates material and tangible infrastructures. These infrastructures bring rare-earth minerals, electricity infrastructures, laboring bodies, fiber optic cables, knowledge, code, water, and fossil fuel together in a disturbing whole. If dams are technonatural, then by the same logic, so too are data centers.

Even more, like dams, we can see data infrastructures as the unfolding of a specific historical-geographical moment

corresponding to digital capitalism. As Pickren (2018: 226) argues, 'examination of the networks of data centers, (undersea) fiber optic cables, routers, and cell towers that power the transmission of digital data marks big data and ubiquitous computing as a palimpsest, a *layering* of different historical-geographical moments that is unfolding in contingent ways'. Existing technical infrastructures demonstrate the ways in which society rationalizes, controls, and connects natures. Technological systems like data infrastructures are thus not separate from nature or culture. Instead, they are expressions of both, and productive of both. Natureculture shapes and is shaped by (digital) technologies. We see digital capitalism as producing a new 'layer' of infrastructure that is at once technical, social, and environmental. Demonstrated by the energy and water needs of data centers in towns like Quincy, Washington (where Microsoft and Yahoo located data centers), Pickren (2018: 236) notes 'computing and data are far from "virtual" and immaterial; the digital economy is extractive, resource-intensive, and defined by flows hidden at the point of consumption'.

The epigraph at the beginning of this section, culled from Amazon's own website about its data centers, takes the idea of the layer at a solely technical level, focusing on data infrastructures. It references the (near) instantaneous and (near) global reach of data that depend on networks of electricity, backup electricity systems, the production of data center buildings that meet strict requirements for cooling and insulation, connections to high-speed internet infrastructure, computers and servers, but, often forgotten, connections to technology hub centers like Silicon Valley, Portland, and Seattle (Facebook and Apple data centers in Prineville, Oregon are adjacent to a private airport and near Redmond, Oregon which has daily flights to San Francisco). The computers within the data center depend on knowledge and production networks, software, and the need to connect to computers which route internet traffic and users which access and retrieve data. They also depend on agglomerations of people (in cities) using digital technologies and engaging in social activities that generate data for delivering services, selling ads, and building additional software.

Data infrastructures are both urban and rural. They connect places like Prineville to San Francisco. But how might we think relationally about the materiality of data infrastructure that connects these urban and rural communities? What does the layering of infrastructures tell us about the ways in which digital capitalism might expand uneven development? To

answer these questions, we can consider how urbanization is not only about cities themselves, but processes that interlink urban and rural communities.

Urbanization and Appropriation

In the same ways that urban areas depend on agricultural lands and distant resources for food, energy, materials, and water, the growth of digital capitalism also depends on rural resources to power and secure our Facebook status updates, Google photos, Kindle obsessions, Netflix streaming services, and iTunes music libraries. The movement towards centralized cloud-computing and data storage at large scale facilities in rural places like Prineville, Umatilla, and The Dalles, constitutes a basis for our everyday urban social lives and economies. Digital media consumption and production (cognitive labor) agglomerate in urban areas, feeding into broader patterns of urbanization (Zip, Parker, & Wyly, 2013). The growth of smart cities projects and programs have exploded urban data demand and dependency (Kitchin, 2013). The twinned trends of urbanization and digital technology development have fueled (and been fueled by) our current political economic system. The layering of data infrastructures cannot be separated from the successive waves of capitalism and urbanization that mark these historical-geographical moments.

Scholars in urban studies and geography have argued these broad patterns in urbanization under the digital economy are part of a 'third-wave urbanization' (Scott, 2011b). This form of urbanization corresponds to three key aspects of digital capitalism: '(1) the new forces of production that reside in digital technologies of computing and communication; (2) the new divisions of labor that are appearing in the detailed organization of production and in related processes of social re-stratification, and (3) the intensifying role of mental and affective human assets (alternatively, cognition and culture) in the commodity production system at large' (Scott, 2011a: 846).

In Amazon's competition for its second headquarters, municipalities across North America provided large incentive packages. To the surprise of many residents conditioned by years of austerity politics, municipal incentive packages provided millions of dollars in tax breaks and other fiscal rewards. Amazon sought large tracts of land to build or repurpose buildings and an urban grid that fed right back into Amazon 'circuit' through its checkout-less grocery stores, transit networks, and vertical mixed-use developments all

encouraging both social and commercial interactions where users provide volunteered geographic information (VGI). VGI, often as simple as a resident's location or a 'check-in', provide data back to companies like Google, Apple, Facebook, Microsoft, Amazon, Foursquare, Twitter, etc. used to construct advertising profiles and segments for digital capitalist firms to sell advertising space for commodities. Similar to investments in data collection infrastructures on smartphone apps and increasingly built into the fabric of 'smart cities' (Rabari & Storper, 2015), data centers are constructed in cost-effective and 'natural' settings to fulfill Silicon Valley's bottom line interests in public image and profit.

Investment in urban infrastructure facilitate the generation of VGI and are used to accelerate the sale of commodities. As digital capital firms profit, they sink excess capital in the built environment as protection against inevitable crises of capital. That is, firms protect their capital through investment in property in urban areas. However, as we know, this investment isn't idle. Marx shows how this shift in investment assists in the circulation (i.e. purchasing and selling) of commodities themselves, and the credit and money necessary for their circulation (Marx & Engels, 1978). Harvey provides specific examples how this reinvestment often takes the form of investment in the built environment (1981). For Google, Apple, Facebook, Microsoft, and Amazon for example, built environment investments in densifying urban areas (re)produces the conditions necessary for VGI to be created and collected. Amazon's restructuring of Seattle's South Lake Union, Apple's Hyperloop campus (which mimics a miniature city in a suburban campus), Google's Sidewalk Labs projects and partnerships, Twitter's relocation to Market Street in San Francisco all provide tangible examples of this self-serving capital switch.

Firms that operate social media platforms or services of digital capitalism benefit from network effects (Srnicek, 2016). That is, additional digital users of the technologies of these firms increase the value of those technologies and increase the amount of VGI. For example, the value of Facebook is zero if there are no other users. Facebook only gains value when there are lots of users, and specifically, Facebook gains value for an individual when their friends, family, and colleagues also use Facebook. Social interactions produce data. Yet this data is particularly useful if geographic in nature, and, again, the density of interactions increases in dense, urban areas with numerous types of activities. For Facebook, this data is used to both find new users to increase the value of data through

network effects and to create advertising segments in attempts to accelerate the sale of commodities and services. Facebook is an obvious example, but similar benefits from network effects and data production in urban areas are garnered from firms like Google, Apple, Amazon, and the numerous firms that operate on Amazon's digital infrastructure like Twitter and Netflix. As urban areas are redesigned with strong influence from tech firms, they mimic the profitability and data conditions of digital capital by enabling social interactions via digital means, commodity purchases with digital traces, and numerous forms of location-based tracking. These data points require both data storage and analysis that utilize data center such as the ones in the Pacific Northwest.

The growth in the tech industry of the Silicon Forest (Portland and Seattle) has been met with a massive growth in urban population. For example, from 2006-2016, Seattle city has grown by over 150,000 residents, or by twenty-five percent (US Census Bureau, 2016). Seattle is a distinctive example of Scott's (2011b) third-wave hypothesis with its particular forms of tech-led urban development and increasing social stratification and contestation marked by new patterns of gentrification and 'aestheticized land uses'. Recent struggles over affordable housing and Amazon's attempts to fight new taxes on large corporations have re-centered the importance of such struggles of digital capitalism in the everyday lives of workers, or what Scott (2011b) calls 'the new service underclass'.

In the face of such struggles, we should be considering what is driving the growth in digital capitalism and how this growth reshapes both the urban and the rural. As investments in urban infrastructure led by Paul Allen's Vulcan transform entire swaths of Seattle's downtown, in South Lake Union for example (Harris, 2016), and as Jeff Bezos fights against a head tax ($520 per employee for Amazon's 50,000 Seattle employees) earmarked to address Seattle's affordable housing crisis, in what image are we producing the city and nature? Digital capitalism is driving forms of dense urbanization that are fueled by the commodification and extraction of data about our everyday social lives, our movements, consumption, likes, tweets, Instagram photos, and general social knowledge. The restructuring of Seattle leads to agglomerations in urban data production, which rely on rural data storage and analysis. This is a model of accumulation that is fundamentally extractive under conditions of significant power differential between firms and users (Thatcher, 2013; Thatcher, O'Sullivan, & Mahmoudi, 2016). Just as Facebook and Google use rural

Oregon for their 'natural' resources, they use cities and agglomerations of 'users' to extract data. We can and should unpack these forms of extractivism in digital capitalism to find ways to resist and unearth alternatives.

Conclusion

In this essay, we traced some of connections, displacements, and inequalities that are found along data infrastructures. If we follow from data centers in rural communities to smart cities produced in the image of large corporations, we find extractive logics all along the way. Choosing data centers and infrastructures as the site for investigation of the relationship between digital capitalism and nature is strategic. It reveals a complex relationship between urbanization as a planetary scale process linking urban and rural communities, facilitating flows of nature (energy, water, food, waste, etc.) in circulations and metabolisms that reproduce digital capitalism. In the first section, we showed how nature is constructed as both a resource and a greenwashing strategy for data centers. Then, we turned towards the metaphor of layering to understand how data infrastructures are a specific expression of digital capitalism's secondary circuit at this historical-geographical moment. Growth in data infrastructures, as an expression of digital capitalism's secondary circuit of fixed capital, is driven by the logic of exploitation of social production through digital means. Everyday life, subjectivity, and social knowledge become reduced to data resources for extraction by digital capitalists. This is the basis of third-wave urbanization, which we discussed in the third section, highlighting how this mode of capital accumulation is leading to new fractures and inequalities in cities like Seattle.

But there is still so much more to do. What inequities are arising in the uneven development of data infrastructures within *and* beyond cities? How might we extend analyses of data centers and data infrastructures to understand the relationship between computing and socio-natural change? And how might these mappings elucidate new areas for contestation and resistance? What are the possibilities for more sustainable and equitable alternatives in digital economies? This essay perhaps raises more questions than it answers, but our goal here is to provoke critical reflection on the interconnections between nature, urbanization, and computation. After all, paraphrasing Marx, nature builds no data centers.

Notes

1. Beck, 2008. 'Welcome to Googleville.' Available at: http://www.wweek.com/portland/article-9089-welcome-to-googleville.html.

2. Self-reported by Google: http://www.thedalleschronicle.com/news/2018/apr/30/google-investment-td-18b/

3. Google's existing facilities are located on land purchased from Port of The Dalles (and they are lauded for their $1.8 billion in investment, mostly capital for computing infrastructure). Local communities and the Mayor of The Dalles have celebrated Google's investment in a 'globalized export economy'.

4. Job advertisements from Facebook, for example, describe this. Available at: https://www.facebook.com/careers/jobs/a0I1H00000MoH9QUAV/.

5. Oregon's enterprise zones and local property tax deals are saving Facebook and Apple tens of millions of dollars annually. But reliance on a single large employer brings back memories of the loss of the aluminum industry, and some community members have been cautiously optimistic about the influx of jobs and tax dollars.

6. Available since 2009, Apple's environmental responsibility report has been heavily criticized: https://www.apple.com/ca/environment/reports.

7. For example, Google describes their renewable energy commitments on their own webpage, likely stored on servers in The Dalles: https://www.google.com/about/datacenters/renewable/.

8. Sourced from AWS webpage, stored on AWS servers, likely in Umatilla: https://aws.amazon.com/compliance/data-center/infrastructure-layer/

References

Caraway, B. R. (2017) 'Literal Media Ecology: Crisis in the Conditions of Production', *Television & New Media* 19(5): 486-503.

Cubitt, S. (2016) *Finite Media: Environmental Implications of Digital Technologies*. Durham: Duke University Press.

Fraser, N. (2014) 'Can society be commodities all the way down? Post-Polanyian reflections on capitalist crisis', *Economy and Society 43*(4): 541-558.

Gabrys, J. (2011) *Digital Rubbish: A Natural History of Electronics*. Ann Arbor: University of Michigan Press.

Gregg, M. (2015) 'Inside the Data Spectacle', *Television & New Media* 16(1): 37-51.

Harris, G. K. (2016) *The Coordinated City's Mutation Machine: Capitalism, Sympathy, and Urbanization in Seattle's South Lake Union Neighborhood* (Thesis). Retrieved from https://digital.lib.washington.edu:443/researchworks/handle/1773/36507.

Harvey, D. (1981) 'The Spatial Fix – Hegel, Von Thunen, and Marx', *Antipode* 13(3): 1-12.

Harvey, D. (2006) *The Limits to Capital*. London: Verso.

Hogan, M. (2015) 'Data flows and water woes: The Utah Data Center', *Big Data & Society 2*(2) (December 2015): https://doi.org/10.1177/2053951715592429.

Kitchin, R. (2013) 'The real-time city? Big data and smart urbanism', *GeoJournal* 79(1): 1-14.

Mahmoudi, D., & Levenda, A. (2016) 'Beyond the Screen: Uneven Geographies, Digital Labour, and the City of Cognitive-Cultural Capitalism', *TripleC: Communication, Capitalism & Critique. Open Access Journal for a Global Sustainable Information Society* 14(1): 99-120.

Marx, K. (1973) *Grundrisse*. London: Penguin Adult.

Marx, K., & Engels, F. (1978) *The Marx-Engels Reader*, R. C. Tucker (ed). London: W. W. Norton & Company.

Merrifield, A. (2012) 'The Politics of the encounter and the urbanization of the world', *City* 16(3): 269-283.

Merrifield, A. (2013) 'The planetary urbanization of non-work', *City* 17(1): 20-36.

Moore, J. W. (2015) *Capitalism in the Web of Life: Ecology and the Accumulation of Capital*. New York: Verso.

Negri, A. (2018) *From the Factory to the Metropolis: Essays*. New York: Wiley.

Peters, J. D. (2015) *The Marvelous Clouds: Toward a Philosophy of Elemental Media*. Chicago: University of Chicago Press.

Pickren, G. (2018) ' "The global assemblage of digital flow": Critical data studies and the infrastructures of computing', *Progress in Human Geography* 42(2): 225-243.

Rabari, C., & Storper, M. (2015) 'The digital skin of cities: urban theory and research in the age of the sensored and metered city, ubiquitous computing and big data', *Cambridge Journal of Regions, Economy and Society* 8(1): 27-42.

Scott, A. J. (2011a) 'A World in Emergence: Notes Toward a Resynthesis of Urban-Economic Geography for the 21st Century', *Urban Geography* 32(6): 845-870.

Scott, A. J. (2011b) 'Emerging cities of the third wave', *City* 15(3-4): 289-321.

Smith, N (2010) *Uneven Development: Nature, Capital, and the Production of Space*. Athens and London: University of Georgia Press.

Srnicek, N. (2016) *Platform Capitalism*. London: John Wiley & Sons.

Starosielski, N., & Walker, J. (2016) *Sustainable Media: Critical Approaches to Media and Environment*. New York: Routledge.

Swyngedouw, E. (2007) 'Technonatural revolutions: the scalar politics of Franco's hydro-social dream for Spain, 1939–1975', *Transactions of the Institute of British Geographers* 32(1): 9-28.

Thatcher, J. (2013) 'Living on fumes: Digital footprints, data fumes, and the limitations of spatial big data', in *Association of American Geographers Annual Meeting, Los Angeles, CA* (8-13). Retrieved from http://jimthatcher.net/wp-content/uploads/2013/10/Living-on-Fumes.pdf.

Thatcher, Jim, O'Sullivan, D., & Mahmoudi, D. (2016) 'Data colonialism through accumulation by dispossession: New metaphors for daily data', *Environment and Planning D: Society and Space* 34(6): 990-1006.

US Census Bureau. (2016) *2012-2016 American Community Survey 5-Year Estimates*. Washington, D.C.: US Census Bureau.

White, R. (1995) *The Organic Machine: The Remaking of the Columbia River*. New York: Hill and Wang.

Wyly, E. K., & Dhillon, J. K. (2018) 'Planetary Kantsaywhere', *City* 22(1): 130-151.

Zip, L., Parker, R., & Wyly, E. (2013) 'Facebook as a Way of Life: Louis Wirth in the Social Network', *The Geographical Bulletin* 54(2): 77-98.