Chapter 14
How Digital Geographies Render Value: Geofences, the Blockchain, and the Possibilities of Slow Alternatives

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Digital Geography Renderings

This chapter examines how digital geographies can be mobilized to create, capture, and extract innovative forms of value that enable and deepen (post)neoliberal forms of urban growth. The main argument is that digital geographies are used to create new urban growth markets through the production of different forms of value. Specifically, I focus on two examples of digital geography and the forms of value that they render:

1. Geofences and geoframing (*subjects* and new forms of geo-subjectification)
2. Cryptocurrencies and non-fungible tokens (NFTs) that produce a new politics of "exit"

Both geofences/geoframing and cryptocurrency on the blockchain are specific instances of new markets, and, I would suggest, intersect with the concerns of digital geographers. Yet we have not talked much about how digital geographies are enrolled in the formation of new markets, despite the increasing interest in financialization and fintech. To some extent this represents the youth of digital geographies as a subdiscipline. It was only in 2016 that a specific "digital turn" was identified in geography (Ash, Kitchin, & Leszczynski, 2016) with a key organizing framework for dealing with digital geography's materiality appearing six years later (Zook & McCanless, 2022). It is time for digital geographers and others interested in digital urbanism to understand these new markets and how they operate. What I aim to

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do here is not so much to interpret them on their own terms, that is, what they may claim about themselves, but to offer a critique or problematization that creates a different perspective, a slight turning or angle of view. The purpose to provide ground for an interpretation that is situated in two related lines of thought regarding digital urbanism today; that is, the *rentier* and the *rendering*.

The rentier model of digital urbanism is marked by the increasing privatization of formerly public spaces and institutions, or what planners call privately owned public space (POPS) (Kayden, 2000). These privatized spaces often have the appearance of being public spaces such as gardens, fountains and public-like squares, but are privately owned and controlled (Minton, 2016). As applied to digital urbanism, the most fundamental of these is the Internet itself. Although it was developed by public agencies within the academic-military nexus, it was privatized in 1995, which then led to the dot-com boom and bust of 2000 (Tarnoff, 2022). Such privatization allows economic relations to be established in which value (usually monetary) can be extracted through the rentier-tenant relation or its digital economy equivalent. Sadowski for example has proposed that corporate technology platforms are increasingly interdigitated with urban infrastructures where they can now act as rentiers (Sadowski, 2020). On this model rentiers do not produce value, or innovate new processes or services, but merely sit and collect takings (fees, subscriptions, and other payments). Rentiers derive their rents because they hold exclusive access to goods and services. Internet service providers (ISPs) such as Verizon or British Telecom for example, can rent out their modems to subscribers who pay them fees to access the Internet. In doing so, ISPs do not innovate or act as entrepreneurs but sell access. Rentier economics is therefore characterized by "having rather than doing," and digital platform urbanism constitutes one of the main ways it operates as a form of rentier capitalism and more specifically platform rents (Christophers, 2020).

Using a threefold typology of platform urbanism, acting concurrently to one another, Sadowski identifies three interdigitated relations between platforms and the urban. These are (1) the operation of platforms to provide *oversight* of city governance; (2) to *operate* city services; and (3) their *ownership* or sovereignty of city spaces (Sadowski, 2020, 2021). Although the first two enumerated stages are by now increasingly familiar, involving as they do the installation of smart sensors and surveillance devices (traffic cams, air pollution monitors and so on) in the first case (that is, the now familiar smart city), and urban dashboards, urban analytics, and the corporatization of economic and social interactions on platforms in the second case (that is, platform urbanism), it is the third or ownership phase that is most relevant for our discussion because it focuses squarely on the rentier. A key point concerning such ownership is that it is not just about portfolio diversification (investments seeking a return), but about governance through control:

> The ownership of territory—in the sense not just of constructing and managing a building, but also of the provision of infrastructure and governance—grants technology capital even greater *dominion* over and data about people, places and processes in the city. (Sadowski, 2021, p. 1737, emphasis added)

Although I concur with this analysis (Sadowski provides a number of illustrative examples), it is also possible to push this argument to explore how specific forms of digital geographies work to create new growth markets and new forms of value beyond the monetary. To do so, I utilize and contribute to the classic theory of the urban growth machine, now recast as the digital growth machine, to pick out new digital *renderings* of the city, using a term introduced by Rosen and Alvarez-León (2022). Renderings are where a more explicitly digital geographical process can be discerned that operate and mobilize rentier capitalism.

Although Rosen and Alvarez-León (2022) only incidentally refer to the term "rendering" it is worth noting its incredible richness and complexity. "Render" is a verb and a noun with a long etymology that traces back to *re-* (prefix) + *dare* (to give). To render is to give (back), to give in exchange, to produce, to give up, and to represent or portray. In law it means to convey in the sense of yielding property, or a payment, in finance there is a sense of rendering accounts, and in computing there is a sense of rendering or drawing a scene or image. Throughout these definitions there is a strong sense of something owed or paid out, as well as a representation, often visual in nature. "Renter" and "render" are etymologically connected; to rent and to rend both share senses of giving (back) or giving up (compare surrender, to give oneself up). Finally, the Latin root word *dare* (to give) is also the etymology of the word datum (plural data), a useful reminder that what is given and taken in digital geography rents and renderings are data.

In other words, a rendering is a form of data representation that can be extracted as rent. Notably when we speak of rent we often have monetary value in mind, but as I hope to show below, other forms of value are also possible, especially as forms of human subjectification.

Rosen and Alvarez-León (2022) emphasize two points; first, urban elites capture decision-making and control over urban governance through renderings; and second, that despite seeking to be positioned as digital, these processes depend upon land, or what Sadowski (2021) calls *territory*. As Rosen and Alvarez-León (2022, p. 14) note:

> Land remains the foundation of urban growth possibilities—even as it is transformed via digital means. Despite the increasingly digitized character of the contemporary economy, where the technology industry coordinates with urban elites to advance digitally oriented capital accumulation and consumptive possibilities, growth is still predicated on spatial relationships and expressions, where land remains a common and key asset.

What the digital growth machine logic reveals is the emphasis on the creation of new markets to pursue and profit from growth, not only from capital accumulation, but of other forms of value that derive from digital geographic renderings.

To explore these variant forms of value, I discuss two digital geography renderings. I argue that these forms produce value through the production of specific *subjects* and a politic of *exit* from traditional geopolitical systems.

Geofences and Geoframing: The Production of Subjects

A geofence is a virtual boundary. A geofence or reverse location search is the search of a database covering a specific geographical area (either stationary or mobile) for a specific time. It is a “reverse” search in the sense that unlike a typical search to find a known suspect’s geolocational data, it begins with a known location and attempts to identify individuals or suspects. Courts have described geofences as a net that is thrown over an area, usually for devices (e.g., smartphones) that may have been inside the geofenced area, as defined by a bounding box of latitude and longitude coordinates (see Fig. 14.1). Everyone who entered that bounding box is problematized as a potential risky subject or in the case of commercial geofencing as a person of interest to capital.

Geofences have been widely used in the advertising and geotargeting industry as a more granular form of customer characterization to improve on classic geodemographics. In the latter, areas such as zip or post codes are given profiles according to the types of people who may live there (e.g., “upwardly mobile young couples” or “urban gentrifiers”). These profiles are derived from census data, customer surveys, point of sale data and so on. With the advent of mobile phones, advertisers can dramatically improve on geodemographics in two ways: the area of interest can be updated dynamically, and they can access individual customer profiles. When an individual enters a geofenced area, messages or promotions can be delivered, their e-scooter may slow down or even halt, or their route may be recorded and saved to a database and made available to law enforcement, or for targeting subsequently by a political campaign. Geoframing uses this historical data (e.g., a store could access all the devices that were nearby over the last few months) to identify the owner of the device and their home address, and to continue sending advertising, either to the mobile device, or to the home address. Third party data brokers such as SafeGraph, Acxiom, and L2 access, compile and sell these records in a largely unregulated marketplace, with scant protection of these data from re-identification (if anonymized), or data breaches.

One of the most powerful features of such a search—so powerful in fact that it shocked the US Supreme Court into requiring a warrant—is that the search can take place retroactively, or as the justices put it, “[geofences] give the Government near perfect surveillance and allow it to travel back in time” to any place on earth and look inside everyone’s phone (*Carpenter v. United States*, 2018, p. 2). Because it is a search of a database of people’s phones, it is the opposite of a targeted form of surveillance that seeks to examine a specific subject’s property or dwelling-place; it will look at everyone, whether guilty or innocent, who entered the geofenced area.

Geofences often use maps, GIS and other forms of geolocational renderings such as bounding boxes to operate. Geofences can often seem to be quite targeted, but if they fall over a densely populated or well-travelled highway the search can be quite expansive. In a case in Chicago involving the theft and transport of pharmaceuticals, for instance, law enforcement asked for three geofences, each one covering over 31,000 square meters, or more than 330,000 square feet. As the court noted, this is

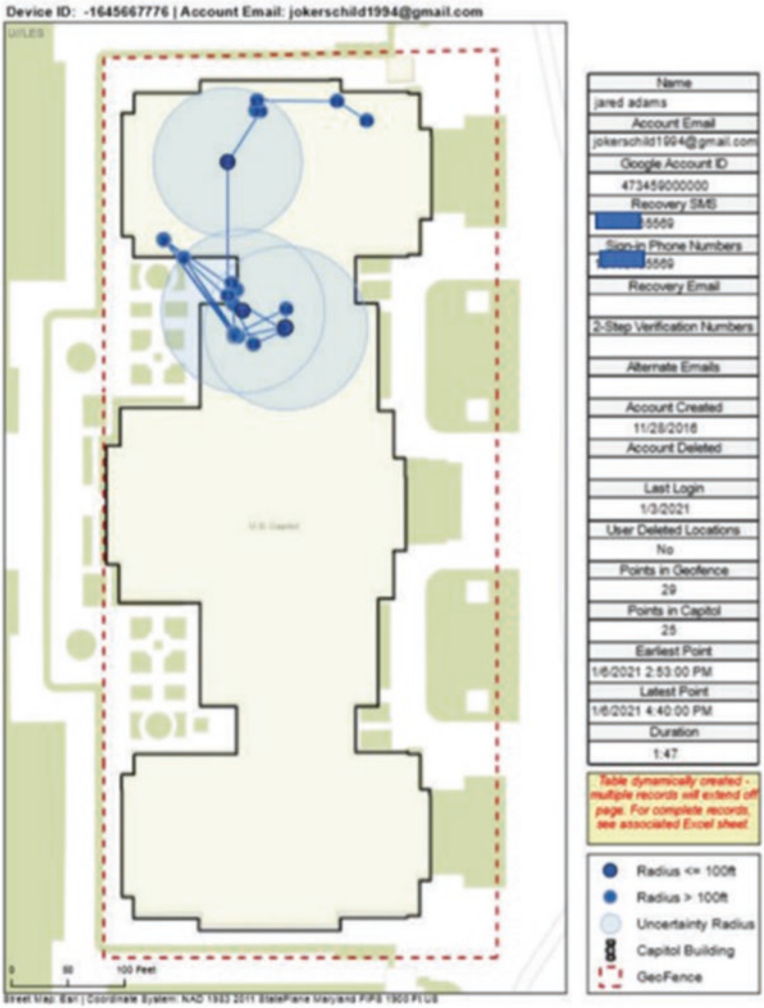

Fig. 14.1 Map of the US Capitol provided by the FBI in the case against Jared Adams aka "jokerschild1994". Geofenced area indicated by dashed line. Reprinted from "Jared Adams Statement of Facts", George Washington University Program on Extremism (FBI, 2021, p. 4). Copyright by Federal Bureau of Investigation 2021. Reprinted with permission

only the surface area; there were multiple commercial buildings, a multi-story residential building, and a gym within the geofence. In another case in Minneapolis a geofence search had the potential to gather data on "tens of thousands" of people (Webster, 2019). It is this sweeping and exhaustive search capability that led the US

Supreme Court to strike down the conviction of Carpenter based on a lack of warrant for his cell tower data.

However, the ruling provided only a brief respite as law enforcement has now turned to purchasing or otherwise acquiring location data directly from private vendors such as Google and Amazon, or from third party data brokers. In "real-time bidding" for example, a web-page user's data is shared with data brokers and adtech companies hundreds of times a day, including the user's internet protocol (IP) address and location data (Wodinsky, 2022).

Additionally, GPS data are much more locationally specific than cell tower data; while the latter may only narrow down to a few city blocks, GPS can often be as precise as 5 m, or the difference between being inside a building or not. A dramatic example of the importance of this level of precision occurred during the illegal storming of the US Capitol Building on January 6, 2021, which occurred in the immediate aftermath of Donald Trump's presidential election loss to Joe Biden. During this event, hundreds of Trump supporters forced their way into the government building where the certification of the election results was occurring, forcing the rapid evacuation of members of Congress and the then Vice President Mike Pence. In some of the charges against suspects, the FBI have cited geofence data to show that someone was inside the Capitol Building (criminal trespass and obstructing Congress) as opposed to standing outside it (not a crime of trespass). The difference may be only a matter of feet, but the consequences are very different: obstructing Congress is a felony and carries up to a 20-year sentence.

As can be seen in Figure 14.1, one suspect, a man called Jared Adams aka "jokerschild1994" had his location recorded by Google's "blue dot" display radius symbology to show where Google believes the person (or their device) is located with 68% certainty. Using these data the FBI was able to secure a conviction of Adams (FBI, 2021).

An initial review of bibliometric databases indicates that geographers have not yet engaged with the social, political or privacy implications of geofences (for reviews in the legal and transportation sectors see Amster & Diehl, 2022; Moran, 2021). Yet such precise locational information that promises to problematize individuals as risky subjects or persons of interest is largely unregulated and is left to the corporate policies and incentives of the companies concerned. This gives companies such as Google and thousands of data brokers tremendous power and at the same time a lack of accountability.

The rentier model of the economy affords an opportunity to understand something of a shift from the classic competition-driven marketplace, where more efficient innovations drive down costs (e.g., through automation) and increase productivity. As a number of writers have pointed out, growth (including innovation) in western democracies has slowed if not halted (Gordon, 2016), but this does not mean that the production of value by other means has similarly halted. Indeed, geofences and their production of actionable subjectivities whether as potential "dangerous individuals" who must be identified and governed (Foucault, 1978) or as persons of interest to corporate entities and data brokers, clearly produce value in the rentier economy. It is also perhaps not even correct to say that innovation is lacking (assuming that innovation is always tied to the production of value) but by slightly turning the question of innovation we can postulate that a different form of innovation is at stake; one that is extractive and exploitative, or what we might call toxic innovation. Geofences have created a new market in the production of human subjectivities based on geolocational data. I will return to this distinction below in my discussion of an alternative form of responsible innovation.

Leaving Traditional and Constructing New Territorial Systems: Cryptocurrency, the Metaverse, and NFTs on the Blockchain

The startling rise and demise of cryptocurrency over the last decade and a half has so far attracted little attention in geography or geo-fintech. With few exceptions (Rodima-Taylor, 2021; Zook & McCanless, 2022) digital geographers and those working on the technological and geographical have yet to contribute substantially to our understanding of the blockchain and cryptocurrencies. Yet at one point cryptocurrencies were worth over three trillion dollars (on paper) with two thirds of that value being wiped out in the so-called "crypto winter" of 2022 (named after the AI Winter of the 1990s when interest in AI declined sharply). The blockchain has also been invoked as the ultimate backstop for a wide range of information technology and radical new forms of political economy such as longtermism and effective altruism (EA) that have proven popular in the digital tech industry. The question therefore arises how best to grapple with geographical interests at play in the crypto-blockchain sector, not least its political and economic geographies.

In this chapter I approach the blockchain, cryptocurrencies and non-fungible tokens (NFTs) as digital geographic renderings that produce new imaginaries of political geography: a new politics of exit. While this exit may involve a literal exit from planet earth to colonies on the moon or Mars and beyond as envisaged by Elon Musk, or an exit from landed territories such as sea steading, more typically the politics of exit is from the financial sector and more ambitiously from the state or even in some formulations from democracy itself. For some blockchain enthusiasts exit from the state is achieved by conceiving of nation-states as "startups" or "cloud countries" (Srinivasan, 2022) wherein a new "network state" is envisaged that will connect people across different geographies. Such network states are imagined by Srinivasan as self-governed, can act collectively, are on the blockchain, have a strong founding leader figure, and have diplomatic recognition of its physical territories, among other attributes (Srinivasan, 2022). For example, crypto-investors attempted to buy an island in Fiji—"a crypto-paradise" promised the advertising—using 10,000 NFTs to buy plots of land. Although it quickly folded due to lack of investment (Butler, 2022), it is only one of numerous attempts to put territories, properties and real estate on the blockchain. According to one of its leading proponents “the point is that a network state is *not* a purely digital thing. It has a substantial physical component” (Srinivasan, 2022, p. 224, original emphasis).

If it seems novel that states verify their assets and values on the blockchain, it should be born in mind that they still bear all the hallmarks of financial speculative assets which are expected to yield a return (i.e., rent). This is especially true of cryptocurrencies, which despite their name do not typically operate as such—they can typically be used only to buy other cryptocurrencies or NFTs (car manufacturer Tesla ended a three-month experiment with Bitcoin payments in May 2021). People buy cryptocurrencies because they speculate that their price will rise. They make these speculations in the knowledge that cryptocurrencies are like financial securities, and they are cryptographically verified on the block chain. True, the value of a cryptocurrency may decline rather than increase, but the same is true of all assets. The key point is that they are not secured via regulation or financial institutions but by means of exit.

These kinds of activities represent new, almost unlimited spaces for capital to be invested, but despite their novelty are clearly not so different from previous rounds of value creation and extraction that characterizes the digital growth machine: namely rent-seeking assets enabled through privatization and monopoly control. It is also worth clarifying that as an innovation the crypto-blockchain is primarily an extractive one rather than one that creates value. As Christophers observes “[r]entierism is fundamentally about securing, protecting and sweating scarce assets” (2020, p. 90). On this model, the goal is to make crypto (and its infrastructure such as the internet) a scarce asset requiring a buy-in.[1]

In addition to purchasing physical land, digital real estate investors have bought virtual plots of land. It is here we see most clearly how digital geography renderings are enrolled in the growth machine, often via the mechanism of NFTs. These virtual spaces are often dubbed the metaverse, although that term is lacking in clarity, and can include virtual reality (VR) games, augmented reality, network states, and web3. In the next section I want to unpack some of these confusing and nebulous terms, beginning with one of the more spectacularly unsuccessful examples of exit, NFTs. However, I want to emphasize that a lot of this constellation of terms and concepts are interlocking, and that there are other areas, such as digital twins, that have been more successful.

Metaverse virtual spaces, or “lands,” are bought with cryptocurrency (typically Ethereum) through exchange platforms such as Opensea and WeMeta. The latter currently trades seven metaverse economies, including The Sandbox, Decentraland, NFT Worlds, and four much smaller ones (the metaverse market suffered a crash at

[1] There is currently legal and juridical uncertainty whether cryptocurrencies are more like assets or securities. In the USA, both the Securities Exchange Commission (SEC) and the Commodities Futures Trading Commission (CFTC) have made claims about legislative jurisdiction. In June 2022 a bill was sponsored in the US by Senators Lummis and Gilliland to regulate cryptocurrencies in the more crypto-friendly CFTC, positioning crypto more akin to assets than securities. Crypto lobbyists praised the bill (Newmyer, 2022), while the SEC has pursued a more vigorous investigatory path (del Castillo, 2022).

about the same time as the crypto-winter in March 2022). Others abound with names like EveryRealm, SuperWorld and Legacy, "an NFT-powered recreation of London" (The Economist, 2022). Land on these platforms can be bought and sold. In 2021 virtual real estate investor Republic Realm bought a patch of land in Decentraland for more than US$900,000 and land in The Sandbox for US$4.3m, and has investments in 23 metaverse platforms (Howcroft, 2021; The Economist, 2022). The auction house Sotheby's, which has been involved in multiple NFT auctions, has duplicated a model of their London offices in the metaverse to which they control access.

Perhaps the closest realization of land and location purchases on the blockchain is Earth2.io. Founded in late 2020, it is positioned as a massive digital game, the first phase of which is purchasing and trading real-world (earth-1) locations and claiming ownership over them (e.g., planting an American flag over the Sydney Opera House). Land can be purchased as an NFT from a map (powered by MapBox) as 10 m^2 tiles, (5.1 trillion tiles, of which 50 billion are purchasable), has improvement fees, income tax and so on. According to the guide its main purpose is to create a whole virtual reality game, but as of the end of 2022, the focus is entirely on making a profit through land trades and might best be described as a geographical "front-end" to give life to NFTs. Land is divided into a limited number of premium Class 1 tiles, and greater numbers of less expensive class 2 and 3 tiles. Looking past some of the Borges-like claims ("a 1:1 map of the entire earth . . .") we still might be forgiven for seeing this only as a bitcoin trading scheme, but its choice of implementation is still of interest geographically.

The initially stated purpose of the blockchain was to solve a problem with digital currencies; namely how could it be verified that a digital monetary asset had been spent, without using a trusted third party such as a bank or financial clearing house—a problem known as double-spending. The answer—Bitcoin—was provided in a paper by Satoshi Nakamoto, a person or persons still unknown (Nakamoto, 2008). Nakamoto's goal to operate outside the banking system made the problem very difficult. Banks and totally digital payment systems such as PayPal (established 10 years before Bitcoin in 1998) had to solve double-spending by using a trusted third party, and therefore centralizing control, trust and point of failure. Nakamoto's goal was to exit from this centralized system and to circumvent the need for trust altogether by developing the blockchain—a cryptographically verified ledger or database that could record and verify all transactions. Additionally, only valid transactions can be recorded, a process known as proof-of-work, which in the case of Bitcoin and subsequent cryptocurrencies meant computationally solving an arbitrary mathematical puzzle, commonly known as mining. Tremendous computational resources are required to solve these abstract puzzles, none of which are real-world problems, giving rise to shortages of computer parts (especially GPUs) causing tremendous price inflation for computer chips, and negative environmental impacts from energy consumption and the carbon footprint of the mining farms. Some crypto-advocates such as the former WeWork CEO Adam Neumann have proposed using cryptocurrencies to fight climate change, but these typically rely on the largely unproven concept of carbon credits. China banned crypto-mining and trading in September 2021 which partially alleviated GPU shortages in order to maintain central control over the banking sector and reserve power assets for other activities. More recently the industry (including Ethereum which developed the smart contract) has flirted with proof-of-stake consensus, which uses far less energy since it is not based on mining—however, it completely removes the original decentralized mechanism since it relies on who is invested with valuable coins (either total worth or some other value captured in an on-chain census). It would also significantly "un-level" the playing field that crypto is meant to play on, and concentrate wealth and power in an oligarchic elite. A "stake" is after all an item of value, and capital will not be just allowed to lie around, but like an accretion disk around a massive black hole will fall swiftly into the orbit of existing wealth.

It is this form of central, state control that the blockchain was built to supersede, to provide in other words an "exit." The notion of exit has a convoluted history, invoking a gamut of figures from the political far right, libertarians and Silicon Valley investors such as Peter Thiel (co-founder of PayPal). Whether these ideas deserve to be taken seriously is not quite the point; the fact is that these imaginaries are having real-world effects, and as we have seen lie at the heart of the blockchain/crypto-currency and NFT project. Collectively these and associated projects of decentralized finance (DeFi) are known as "Web3" following earlier iterations of the web and the Internet. While the precise definition of Web3 remains amorphous—and for some unrealizable except as a performative utterance attempting but failing to bring into being new realities—for our purposes it has already produced (i.e., rendered) value, namely the politics of exit. As described recently by Smith and Burrows (2021) exit is constituted by a form of warmed-over neoliberalism and techno-libertarianism. Its features include most of those identified by Srinavasan (2022) the former Chief Technology Officer of the cryptocurrency exchange CoinBase for the formation of his network state: freedom over democracy, decentralization, a strong leader figure or sovereign, verification via the blockchain, smart contracts that create consent of the governed (rather than for example trust or lazy patriotism) and "diplomatic recognition" or in Srinivasan's terms "clout" or power (Srinivasan, 2022, p. 228). Smith and Burrows (2021) trace the obsession with exit to the distinction made by Hirschman in 1970 laying out the different options for governance under conditions of decline; exit, voice or loyalty. The main options of exit (e.g., emigration, or exiting a market relation) and voice (e.g., protest or voting) are intercut by loyalty (e.g., patriotism). These are not mutually exclusive categories; in pursuit of exit from "democracy" for example, protest may be necessary. This admixture would be one way of reading the January 6 insurrection in the United States.

The geographical ramifications of the blockchain, decentralization, network states and exit are clearly enormous and I cannot cover them all here. It is worth highlighting some pressing questions however. Who can participate and who is excluded—how are its borders managed? Is access to value on the blockchain equal, or is it concentrated, and to what extent is the blockchain truly decentralized or oligarchic? How does a network state throw around its weight or resolve conflict? Can exit really be achieved and if not what are the intermediate geopolitical configurations? If a state is no longer predicated on a shared territory, but some form of "cloud country," what forms of geopolitical analysis are appropriate to understand it? And perhaps most significant at the moment, what are the material, real-world effects of actually existing exit, especially on inequalities? Although we may not be able to answer these questions yet, I have begun to suggest in this chapter that the politics of exit can be understood through the lens of the digital urban growth machine. Exit on this view is a working example of yet more (post)neoliberal growth, creating new markets as the new "digital fix" for capital. In other words, the metaverse and web3 are neo-libertarian forms of rentier capitalism.

In the remainder of the chapter, I explore some alternatives to growth that do not presume the need for growth but rather slowness, care and repair as values, as well as other forms of exit such as exit to community.

A Slow Data Economy

In this section I wish to discuss alternatives to the digital growth machine exemplified above in terms of geofences and NFTs. If there is a *growth* model, is it possible to posit and develop a non-growth or degrowth model? There is a significant tradition of "slow x" including slow food, slow scholarship, slow cities, as well as slow, no, or even degrowth. There is also "doughnut economics" which similarly questions the need or the advisability of persisting with growth as a goal (Raworth, 2017a, b).

The stated purpose of these approaches varies but can include normative statements to the effect that society should value quality over quantity, or that society is moving too fast and consuming too many resources, leading to negative externalities such as global climate change, or negative wellbeing. Kitchin and Fraser (2020) for example argue that we need to adopt "slow computing" due to a societal obsession with social media and other forms of digital communication that can be unhealthy and addictive.

The slow movement does not advocate a rejection—the slow food movement does not seek to abstain from eating for example—but instead a form of "capital switching" in which investment is switched from a focus on newness and innovation to care and repair.

Here I propose a slow digital data movement around six principles.

Principle 1 A Slow Data Economy should provide a counter narrative to extractive and destructive growth.

Deconstructing the power of innovation helps switch from valuing newness and innovation to care and repair of what already exists. The fetish around innovation sits at odds with the fact that value from innovation has benefited fewer people as it has increasingly been captured by elites, as described in the urban growth machine. Although today we are in the fourth industrial age marked by robots, automation and algorithms, breakthrough innovations seem few and far between. Apple's top product is arguably the iPhone, first introduced 15 years ago in 2007 by Steve Jobs. Despite some 13 operating system revisions, it is not much different today. Such "innovation capture" where digital technology companies acquire competitors and seek rents via licenses of the technology is a key component of rentier capitalism and the establishment of monopolies (Christophers, 2020).

The slowdown in the rate of innovation is recognized by writers across the political spectrum. Peter Thiel often argues that the biggest problem today is stagnation and lack of acceleration—although in his case he advocates for speeding up. Vinsel and Russell (2020) as well the geographer Danny Dorling (2020) argue for a different kind of innovation, rather than assuming that all innovation produces a social good. True, innovation is still linked to value, but drawing on their work along with that of economists (see Kokkoris & Valletti, 2020) we can conceive of different forms of innovation: that which creates values for social good, that which destroys value (sometimes known as toxic innovation), that which extracts value, and the more recent development of responsible innovation.

It has often been noted that today's mega technology companies including Apple, Amazon, Meta/Facebook, and Google have practiced forms of extractive innovation. The argument against such powerful monopolies is that they create inefficiencies in the market; they command higher prices than in competitive markets, but also, they tend to suppress innovation. In the case of the big tech companies, one way this operates is that they remove potential competitors from the market by buying them up and absorbing them. For example, after the company Keyhole has developed a virtual earth viewer, Google bought the company and launched it as Google Earth (Crampton, 2008). Similarly, Amazon is often accused (and was sued for doing so) for killing off not only small bookshops, but also book chains such as Borders and Barnes & Noble. These practices are known as "kill zones" for obvious reasons that big tech kills off small startups. According to a 16-month US Congressional investigation report on digital markets, big tech was found to hold unwarranted monopoly power, and the investigators wrote that they found "significant evidence" of the suppression of innovation, and that this weakened democracy (United States Committee on the Judiciary, 2020). In digital mapping, for example, the investigation found that Google Maps (the market leader) was worth up to US$60 billion for the company, and that its market dominance suppressed the ability of competitors to enter the market (United States Committee on the Judiciary, 2020, p. 108). The U.S. Department of Justice has launched several lawsuits against Google for violating antitrust (monopolistic) regulations under both the Trump and Biden administrations.

Vinsel and Russell (2020) argue that for these reasons, the value of innovations is overblown, and we should divert resources from them in favour of policies that promote repair, maintenance, and care for what we have, instead of building new creations. Although they do not put it this way, perhaps one way to view this is to promote innovation that creates social value, rather than extracts or destroys it. Social value in this sense may come about by maintaining and protecting what we have, rather than new innovations (although sustaining innovations may have a role to play in such sustaining activities). It is possible to detect a flavor of this in projects such as the Green New Deal (GND), supported by progressives in the USA. The GND may be an example of "capital switching" formulated by the economic geographer David Harvey nearly 50 years ago, in which there is a massive switch in the "circuits of capital" from investment in the production of goods and services to investment in infrastructure (Harvey, 1978).

The late British Labour MP, Tony Benn, famously stated five questions of power that we should ask:

> What power have you got? Where did you get it from? In whose interests do you exercise it? To whom are you accountable? And how do we get rid of you? (Benn, 2001, col. 510)

This mantra should remind us where technological accountability should be exercised; both through an un-black boxing such as critical histories of technologies such as GIS and now GeoAI (a form of transparency) and accountability through for example algorithmic impact assessments (AIA). Developed in the US, Canada and the UK, the AIA is a risk-assessment mechanism that could also identify mitigating processes (Reisman, Schultz, Crawford, & Whittaker, 2018).

Principle 2 A Slow Data Economy should be based on local, place-based approaches, and should not scale.

Locally based solutions that are co-developed with locals will be smaller in scale and consume less energy. For example, Newcastle's new building housing computer science, the Urban Science Building (USB) cost £60m but promised to use solar power (photovoltaic arrays) to generate 33,000 kWh/year. As a sensor-enabled building (reputedly containing over 4000 sensors) and tracking CCTV, it also promises to manage lighting and energy costs more efficiently.

We also need to act and think local because of the vast amount of energy required to train machines. The computational power for general AI is staggering. Some 30 billion barrels of oil are produced a year, and a lot of it is used to power the cloud, data centers, and the IoT. Data centers make up nearly half the global carbon footprint of the tech industry (Dobbe & Whittacker, 2019). In response, big tech has taken steps to power data centers with renewables, and just as importantly, to be seen to be doing this via various metrics. In 2020 Microsoft announced a commitment to be carbon negative by 2030 (Microsoft, 2020).

More can be done to expose the environmental costs of AI and to move it towards "green AI" (Schwartz, Dodge, Smith, & Etzioni, 2020). Yet we also must be aware of greenwashing. Vicki Mayer (2021) has identified the "aura" around data centers, or their imaginary—their sustainability, their job creation through multipliers, or their development of under-serviced regions outside the cities. Her fieldwork looks at Google's huge new data center in Eemshaven, Netherlands, part of a €2.5 billion investment by the company in the country. She shows that in fact very few people work in the data centers and that they are not really designed for humans; oxygen is kept significantly lower than normal in order to act as a fire suppressant. The coal-burning power station next door, which powers it, is artfully concealed in advertisements. Most of all however is the way data centers are kept unknowable; all workers sign non-disclosure agreements, the premises are highly securitized and cannot be toured, and many of the non-technical support laborers are held at arm's length via subcontracting on precarious contracts (Mayer, 2021).

Geographers may be particularly interested in Machine Learning (ML) that can use transfer learning to apply a trained model in one location, to another location. A use case would be disaster response, where a ML trained on imagery of building damage in one part of the world, can be used in another part of the world to perform the same task. Conceptually this might amount to training the last few layers of a deep learning model, leaving most layers trained on your original dataset (such as Imagenet). ArcGIS Pro has some tools that will allow this.

For this reason, locally designed AI/ML are preferable. As I discuss next, it is also a powerful democratic process if decision-making about places involves the communities themselves; a tradition in planning going back some decades (Wilson & Tewdwr-Jones, 2022). But how can local residents, who are not technically proficient in AI, co-design how the system might work?

Principle 3 A Slow Data Economy should be inclusionary.

One process of accountability that has received attention lately is human-in-the-loop (HITL) or its extension society-in-the-loop (SITL) (Rahwan, 2018) which refers to the inclusion of human participation in machine learning. It was first proposed in the field of controlled computer systems in the 1990s and more recently for AI. The human-in-the-loop I have in mind is exemplified by recent work by Huck and colleagues (Huck, Perkins, Haworth, Moro, & Nirmalan, 2021). In their study of volunteered geographic information (VGI) they propose a novel method of combatting under-mapped areas that they dub "centaur GIS." This scheme integrates human and machine activities using feature recognition by machine learning, to propose geometries (shapes and locations of buildings, roads and other features in the environment) and feature classification (identifications of which the approved geometries) which are then approved, edited, or rejected by a human participant. This hybrid approach (a centaur is a human-horse hybrid) they argue is superior to one without a human in the loop: essentially the machine learning proposes, and the human disposes, of each geometry and feature classification. One of the advantages of this approach is that it is scalable via VGI; if for example it were implemented in OpenStreetMap (OSM), editors around the world could approve, edit, or reject geometries and/or feature classifications at scale.

The emphasis on this form of in-the-loop work is placed on understanding and meaning. In current AI, the hope is that meaning will emerge naturistically by scaling up—hence the community's excitement about large language models (LLMs) such as Open AI's ChatGPT which produces human-interpretable text given an input. Famously, LLMs have been described as stochastic parrots (Bender, Gebru, McMillan-Major, & Shmitchell, 2021)—repeating much but understanding little. Like a parrot, the machine learning model is without reference to meaning, and Bender et al. (2021) detail a number of risks and harms when the models are used in this way, while recognizing that in other use cases, such as automatic speech recognition, there may be utility in using smaller language models.

In a hybrid model the emergence of meaning is not left to the model but provided by the human, who has a vested stake in the process (e.g., a motivation to use OSM to provide more accessible transportation). This has non-trivial implications—it would put into contention the value of the autonomous vehicle (AV) industry for example, which rely on the model to infer and make judgements about objects in the scene on the currently existing road system (AVs traveling on dedicated lanes may be able to avoid this issue).

Principle 4 Slow data economy should be auditable, accountable and transparent.

Responsible research and innovation (RRI) has been developed in order to more clearly understand harms and risks of technology. It was developed in the European Union around 2010 to inform its funding frameworks following the emergence of the human genome project (Owen, Macnaghten, & Stilgoe, 2012), and similar guidance has been established in the UK and U.S. funding contexts. Nevertheless, legislation by itself will likely prove inadequate as busy researchers will feel an imposed top-down solution rather than self-motivation to practice RRI. One way to address this is to make more mainstream the practice of algorithmic impact assessments (AIAs), which were recommended by the AI Now Institute (Reisman et al., 2018). AIAs provide a framework to ensure public accountability of automated decision-making systems. The framework can include peer review, public commentary, and due process for those affected by the systems. Transparency can be rather hard to pinpoint in a deep learning model with many variables, although explainable AI has made some attempts to address this including in GeoAI (Xing & Sieber, 2021). However, progress has been faced with barriers such as the fact that a GeoAI does not just depend on current conditions (e.g., traffic), but the local semantics of place meanings, or local regulations. Thus, the AI may be unable to a provide an account of its output.

Another way to think about accountability is through affective relations. Meredith Whittaker (2021) suggests that academics and tech industry allies need to organize and develop structures of mutual care. For me this has come about through contributions to establishing pedagogical materials and writings on critique, including holding public webinars on surveillance and geotech, and delivering RRI training to geospatial PhD students. Pedagogy is a form of making allies or in a slight twist of the term the "exit to community" (E2C). Although again not perfect, E2C is the proposition that innovation capture as an end-goal (having the startup bought out by monopolistic but deep-pocketed tech companies, often known as exit) can be replaced by co-creating, co-governing and co-owning (e.g., via trusts) assets for its community (Mannan & Schneider, 2021). There is also the Turing Way, a collaborative project on open research with over 300 contributors. Open research includes not just open access publication of results, but also the code, methods and data used to arrive at those results in order to make reproducibility too easy not to do (The Turing Way Community, 2022). The Turing Way is full of inspiring examples, case studies and discussion—a true pedagogical document.

Principle 5 A Slow Data Economy should anticipate dual-use.

Responsible innovation and dual-use technologies. A dual-use technology is a technology that may find more than one purpose (especially a civilian and a military or law enforcement use). Perhaps all technologies are dual-use? Perhaps, but some alternative uses are arguably worse than others. Think of the humble kitchen knife for example, since time immemorial it has been used to threaten and harm people as well as slice bread or chop vegetables. For this reason, it is sometimes said that it is not possible to prevent nefarious uses of technology, or in milder form technology developers will acknowledge it is possible but not their responsibility (they are just engineers). Yet if you try to board a flight with even a Swiss Army knife or enter a government building with a wrist brace with a metal insert you will soon learn otherwise: it is possible to anticipate and regulate. Yet a knife in most cases can potentially harm only one person at a time. By contrast, accessing and using the vast treasure troves of personally identifiable data online and using them for surveillance or machine learning can and does affect far more people—perhaps nearly all of us. This "platforming" of locational and biometric data not only promises to connect geographically distant actors but to curate new forms of value (Crampton, 2019) by for example collating data from multiple origins into a central database where it can be analytically combined with other data for purposes of decision-making. A 3-year report by the Ada Lovelace Institute across a number of use cases of biometric technologies in public space in the UK found threats to privacy and bias (Ada Lovelace Institute, 2022). Given that these technologies are largely unregulated, the Institute laid out proposed legislative recommendations, including the suspension of live facial recognition and better oversight that could anticipate harms. Perhaps most relevant to our discussion is the proposed standard of proportionality, that is, not a rush to deploy, but a slower, more considered approach: "this proportionality test should consider individual harms, collective harms and societal harms that may arise from the use of biometric technologies" (Ada Lovelace Institute, 2022, p. 55).

Principle 6 A Slow Data Economy should vision the future, and develop critical histories.

One promising solution is to use a gaming approach, as practiced by UN Habitat using the popular Minecraft game (UN Habitat, 2021). UN Habitat is the custodian for Sustainable Development Goal 11, for sustainable cities and communities. Minecraft is a computer video game, which can be quickly taught to participants. Using a Minecraft model of the site to be visioned, participants can work on medium-grade computers to rebuild or try out new designs (the experience is rather like digital 3D Lego building blocks). Building the site can involve taking pictures of the area, working with Google Maps, or tracing the area. Participants can add or move blocks around in the site to visualize a possible future design (see Fig. 14.2).

Creating space for different imaginaries is critical especially when capital itself claims it is the only alternative ("capitalist realism" as captured in the phrase "it is easier to imagine the end of the world, than the end of capitalism" (Fisher, 2009, p. 2). Gaming in Minecraft is not a zero-sum outcome, there is no correct answer, and it stimulates play and experimentation. Future visioning has also been the

Fig. 14.2 Image from Minecraft city visioning workshop for Conakry, Guinea. Source: Reprinted from UN Habitat (2021). Copyright by UN 2021. Reprinted with permission

province of science fiction and science fantasy writers such as Kim Stanley Robinson (e.g., his novel *New York 2140* in which a near-future New York City has been flooded by a 50-foot rise in sea levels due to global warming), or John Brunner's classic 1972 environmental dystopia *The Sheep Look Up*.

We also need to learn from the past in order to understand the present (what Foucault called a genealogy of the present). We need rich histories of the present, especially critical histories of AI and GeoAI. Those histories may even contribute to a kind of counter-narrative, that makes space for problematizing hidden assumptions such as "legislation stifles innovation," or that innovation is a universal social good.

Conclusions

This chapter has examined developments in urban geospatial technologies under the perspective of what Rosen and Alvarez-León (2022) call the digital urban growth machine. As with the original growth machine, the digital manifestation is deeply dependent on material creation and extraction of value. Particularly important though are "renderings" or ways of operationalizing the creation and extraction of value. I argue that they do so under a rentier model, or more broadly a system of rentier capitalism, in which the primary defining feature is owning or controlling particularly assets, that is, having rather than doing (Christophers, 2020). Such ownership enables the creation of and monopolistic control of new digital markets for the generation and appropriation of value; both monetary and non-monetary. Akin to Marx's technological fix and David Harvey's spatial fix (Harvey, 1982), we can see this as a form of "digital fix."

The two domains discussed here, geofences/geoframing and cryptocurrency and NFTs on the blockchain, could be usefully extended. I argued here that as digital geographies operating to sustain rentier capitalism, they are productive of new forms of value. In the case of geofences they *produce new forms of subjectivity*; inasmuch as they concretise the governance relation between individuals and space. Activities within a geofence, whether established as a search zone by a law enforcement agency, or as a no-go area for an e-scooter (where the scooter will slow down or not operate at all) can be governed at the individual rather than the group level. If previously we consider governance applying to spatial units (such as political jurisdictions) we are now able to govern spaces with much more agility and at the level of the individual who enters or occupies them. Agile, because they can apply for short periods of time, and can even be moved along with the movement of problematic subjects. These geographical digital representations, in other words, serve to problematize occupants of both private and public spaces as dangerous or risky individuals. They thus form an ownership over all sorts of new spaces from which value can be extracted in rent form—the creation of value by dint of having rather than creating being the classic definition of the rentier. Yet the societal impacts of geofences—who is making them, profiting from them and especially who is impacted by them remain little studied.

The blockchain and its usage for cryptocurrencies and especially NFTs represent a rather more complex case; more clearly part of the rentier model but less reliant on digital geographic renderings. While there is a strong case to be made that cryptocurrencies offer a "digital fix" as an asset class for speculative capital to flow into, and that monopolistic control of such cryptocurrencies has been the modus operandi since their establishment (and therefore they again fall into the rentier model) it is the NFT market that has tended to more overtly exploit digital geography renderings. Earth2.io is one example, the "metaverse" is another. But it should be recalled that NFTs are deeply tied to cryptocurrencies as their name implies. Being non-fungible, they cannot be exchanged for another asset of the same type—they are unique. This uniqueness has to be secured and acknowledged when it comes to digital assets (for example a jpg image) because an identical copy can be made, but copies lack the entry on the blockchain that make it publicly verifiable as the NFT asset. Furthermore, NFTs are designed to be bought with cryptocurrencies using cryptocurrency wallets, mostly because network or "gas" fees can be charged for each transaction by the marketplaces (that is, fees charged for the computational power to validate the transaction; additional transaction fees may also be charged). All these activities are possible because cryptocurrency and NFTs on the blockchain *produce a new politics of exit*. As Raymond Craib (2022) argues this exit is not new, but the "myth" that escape is possible (Bruggeman, 2022) through decentralization is an extremely useful one for extending the tendrils of the rentier economy into new "cloud countries" (Srinivasan, 2022).

These two domains can be extended, as Rosen and Alvarez León (2022) suggest in a footnote, to digital twins or realtime simulations of buildings and urban areas. Digital twins are often visualizations of such spaces, and as such are *productive of new territories*. These territories are made more governable through control of the sensors and devices that collect realtime data, are processed by optimization algorithms, and fed back with changes to its digital-material infrastructure. In the case of a building information model (BIM) for example, sensors may detect persons entering a room at a particular time and adjust the HVAC systems, heating or cooling the room. What a digital twin permits however, is predictive governance, heating or cooling the room in anticipation of its occupancy. A more complex model may simulate a whole city or even a region. In order to make predictions the models have to be parameterized, especially with population data or a proxy (usually and not necessarily correctly assumed to be growing).

What is perhaps the most surprising about these development however, is that it does not stand unchallenged, and an increasing number of responses, gathered under the banner of slowness are now making themselves heard. In this chapter I have been inspired by this braid of thinking to offer a few principles (by no means exhaustive) for urban geospatial technologies we might label the Slow Data Economy. I offered six principles, starting with counter-narratives to growth. One of the key tasks is to better understand innovation, and to offer another concept of innovation and regulation than the common one that regulation stifles innovation. Here I tried to break open innovation as not being a universal good by understanding different types of innovation; including innovation that extracts and innovation that destroys value. These forms of innovation do need to be stifled; extractive innovations are at the heart of the rentier model. Indeed where "rent-seeking" behavior is most pronounced, that is, where rentiers sit and sweat existing assets rather than innovate, it could be said that extractivism and rentier capitalism aptly demonstrates that innovations for social good such as those that spread their benefits are not just disfavored but actively suppressed. Legislation is clearly needed to rectify this imbalance, for instance by loosening intellectual property (IP) regimes, taxing corporate profits, and incentivizing investment in renewables.

Where algorithms and digital developments are local/non-scalable, inclusionary, and audited we can also provide a slower, more deliberate approach. If we can build in better understandings to anticipation and mitigate how technologies may be used, for example by producing critical histories of GIS, GeoAI, and geotechnologies we can create richer more inclusive visions for the future. These are undoubtedly inadequate by themselves if they are not part of a bigger movement to challenge the ideology of growth. But their possibilities offer a way to think that might yet be a radical response for our times.

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