Introduction

PUTTING DATA IN ITS PLACE

Where Cloud Is Ground is a story about data and place, told from one especially unsettled nexus of technological, geopolitical, and environmental change. It sets out to show how digital data—often imagined as diffuse, ephemeral, immaterial—emerges from particular social and material landscapes, is shaped by them, and reshapes them, in turn. It contends that this data is both a product of place and an essential instrument in the making and claiming of place, today. It makes this case through ethnographic attention to the development of a data storage industry in Iceland: the construction, in industrial parks, across countrysides, and along coastlines, of data centers, or facilities where large quantities of data are processed and stored.

Centering place in a story about data may seem anachronistic, even irrelevant. After all, the language we tend to use to talk about data is resolutely placeless. *The cloud*, our current term for the way in which we access computing products and services over the internet, conjures the feeling that our data is "everywhere and nowhere in particular" (Carruth 2014, 340). As it has become more possible to store and process data at a distance, the vast majority of computation has shifted from servers stored inside our homes and offices to data centers sited around the world. And as

the infrastructures supporting our digital experience get more distributed, it is easier than ever to conceive of the internet as abstract, while harder to consider the question of where our data comes from, and where it goes.

But our data does not condense from nothing and nowhere, nor does it hover benignly in the sky. Fiber-optic cables traverse seabeds to connect continents; internet exchange points physically append multiple networks; and data centers, described by Jen Holt and Patrick Vonderau as "the heart of the cloud and much of its physical infrastructure" (2015, 75), house the servers that store the data on which our online lives depend.

In recent years, Iceland has emerged as a growing hot spot for the international data storage industry. A range of actors here (Icelanders and others) have set about making the case that the island is an especially good place for data to be. This book traces this process of attracting data to Iceland, of making it fit and making it stick here. That work has included activism and engineering, earth moving, parliamentary debates, and professional nation branding. It has also involved displacements, exclusions, and extractions.

We can appreciate as much by considering one landscape that readers are likely to recognize: Iceland's famous interplay of "fire and ice." From seventeenth-century travelogues to today's highly successful tourism campaigns, the island has been associated in outsiders' imaginations with, on the one hand, its sweeping glacial vistas, and, on the other hand, with the thirty active volcano systems that routinely churn red-hot magma up from the earth. Together, these two forces produce an inimitable landscape, in which massive waterfalls cascade over chiseled basalt columns, windswept desert opens up onto lush pastureland, and waves crash onto craggy beaches with sand in striking black and red. In and around the data center, however, fire and ice produce new meanings and new material consequences. Take the perspectives of three of my interlocutors: Mateo, Egill, and Natan.[1]

Mateo is an American data center developer who splits his time between Iceland and the United States. As part of the management team of a data center I'll call Arctera,[2] and a seasoned public speaker on behalf of the industry, he graciously offered to give me the grand tour of his facility in Southwest Iceland. As he led me into a data hall filled with neatly stacked computer servers, Mateo told me that "the abiding principle of a data center is managing hot and cold air." This is because computational

processing generates heat—the same warmth you feel building at the back of your computer if you leave it running too long on your lap—and when servers get hot they run inefficiently, even risk burning themselves out. So for data centers, which house hundreds or even thousands of servers, managing temperature (as well as humidity) is key. At Arctera, this careful balance is established by organizing servers in a series of back-to-back pairs. This staggered system creates what are called "hot aisles" and "cold aisles," or microclimates we could feel on the surface of our skin: cool air was blown up through the floor below us, while the hot air emitted at the back of each server was trapped and efficiently filtered away.

In a warmer climate, like Mateo's native Florida, this cooling process would be very costly, requiring intensive air conditioning. "But in Iceland," Mateo said, smiling, "you just open the windows." What's more, Iceland's glacial rivers and geothermal fields (a product of the island's tectonic activity) produce an annual excess of inexpensive energy, which data centers use to keep their servers running twenty-four hours a day. It was precisely this combination of climate and energy that convinced Arctera to site its data center here. For Mateo, then, Iceland's fire and ice are natural assets that make the island inherently well suited to the industry; they are resources that, with a little engineering, support the basic mission of the data center seamlessly.

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Egill is an Icelander with a background in business, who works at a state-backed but privately partnered agency whose mandate is to attract foreign direct investment. About a decade ago, he was tapped to head up a fledgling effort to build a data center industry in Iceland. So he set about learning how to pitch to people like Mateo—developers looking for a new place to build—and he has carried out that mission with impressive success. Egill's agency often uses natural imagery in its promotional material. Over the years I have collected, from his downtown Reykjavík office, brochures that feature rushing rivers, snow-capped mountains, and almost impossibly blue glacial lagoons. These photos are meant to evoke the connotations Mateo spoke to—the cool climate and abundant energy that can be harnessed for the data center sector. But Egill, who keeps his finger on the

pulse of industry trends and investor attitudes, also knows he has to be careful in communicating this idea of Iceland to the outside.

Consider the Eyjafjallajökull eruption of 2010. Egill and his team had been active for a few years then, making contacts and making the rounds at trade shows, starting to gin up international interest in Iceland as a data center locale. And then, the volcano Eyjafjallajökull erupted, creating an ash cloud that rode the jet stream to Europe and grounded flights across the continent for a week. "You know, not a single light bulb in Iceland went out in that eruption," Egill told me wearily. There was vanishingly little property damage and virtually no injuries. But investors were spooked by the volcano all the same. "People would see our table at the conferences and walk right past us," Egill said. "It was like they thought the whole island was on fire." So after years of focusing their promotional efforts on Iceland's wild and powerful nature, Egill and his team turned to damage control. For the first time, they featured an image of the Reykjavík cityscape on the home page of their investor website. Fire and ice, then, for Egill are symbolic resources to be managed strategically—part of a carefully crafted image of Iceland that walks a fine line between abundance and excess.

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Natan is an environmental activist. Though still young, he has invested much of his life and career in conversations about how Icelanders should relate to the landscape they are, in his view, lucky enough to live amidst. In the past years, Natan has turned his attention to the environmental impact of the data storage industry. Natan told me he isn't against data centers on principle—he understands they serve a function and need energy to run. What he takes issue with is the staging of Iceland as an enclave for them, and more specifically of Iceland's energy potential as endless and without impact. Geothermal energy, he reminds me, comes from drilling boreholes; hydropower comes from damming rivers. As the data center industry continues to expand in Iceland, more energy will be required to meet its needs.

When I asked Natan what motivates his activism on this subject, he told me that his answer to this question had changed: "Five years ago, I

probably would have said we should save nature so people could go and appreciate it. I would have said we should preserve nature for the next generations." But more recently, he has come to understand that position as "too human-centered," and thus not really in line with his values. "Now I say nature should be protected for its own sake, because we have no right to destroy it." By way of example, he turned our conversation toward the ongoing volcanic eruption at Geldingadalir Valley that had started about a month before. As the lava from it had started to slowly flow in the direction of a roadway, construction crews were busily erecting land barriers to reroute its path. "Of course," Natan said, "many people are in favor. But there are also those who say we should let nature take its course, we should appreciate seeing what the lava does on its own. Almost like the lava has its own rights." For Natan, Iceland's fire and ice operate by their own logics, belonging only and fundamentally to themselves. To channel them toward the digital demands of a human population would be shortsighted and unjustifiable.

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These brief snapshots each provide a different entry point into the process of placing data in Iceland: Mateo builds and operates data centers, Egill paves the way for them to come, and Natan endeavors to shift public opinion toward reckoning with their broader impacts. From their different vantage points, they are all deeply and divergently engaged in negotiating the relationship between data and the Icelandic landscape. The chapters that come follow their, and various others', efforts. They also look beyond Iceland's geophysical features to consider how data is equally situated amidst national identities, historical narratives, and postcolonial politics on the North Atlantic's Arctic edge.

In this, the following work has three aims: first, to shed empirical light on data storage infrastructure and industry, in particular how the rapidly proliferating facilities that house our digital data are sited, sold, and run. Tracing these often invisibilized constellations of land, labor, affect, and capital is a vital aspect of understanding our increasingly online lives. The book's second aim is to theorize the broader relationship between place and data, interrogating the ways that data depends on place, and place

depends on data in turn. It does so by taking data storage as a window into still-open questions of spatial politics, sovereignty, and imperial power in Iceland. Finally, its third aim is to offer one model for engaging with the so-called cloud ethnographically, a project in which anthropologists are increasingly enrolled (Douglas-Jones, Walford, and Seaver 2021). Today, even those of us who don't set out to study these systems will nevertheless find them mediating our field experiences, and our interlocutors' lives; in the process, we are faced with new questions—and old ones—about our objects, ethics, and epistemologies. This book offers one example of what it might look like to inquire into what this data is, what it does, and why it matters where it lives.

WHERE DATA LIVES

Attending to the site of data's physical storage, the particular patches of ground that data centers occupy, is only one way of understanding data's relationship to place. One might just as well ask how data constitutes urban spaces (Mattern 2017, 2021), or how data is mobilized in drawing borders and defending them (Chaar-López 2020; Möllers 2020). One might equally trace the ways that data produces space as racialized and is marshalled in the deployment of policing and state violence (Benjamin 2019; Brayne 2020). Or, one might consider the potential of data, collected and directed with care, to foster dynamic and decolonial relationships to locality (Duarte 2017; Hunt and Stevenson 2016). Data storage, then, opens just one window among others onto the project of placing data in the world. But it is, I hope to show, an illuminating vantage point.

A data center, also known colloquially as a "server farm," is simply a facility where data is processed or stored. These are sites where multiple—and often many—servers are run at the same time, sharing space and pooling resources like air conditioning and electricity. Conceptually, data centers are heirs to the "computer rooms" of the 1940s and 1950s, when sprawling mainframes required their own dedicated spaces and technical teams. Computation then took place within a centralized architecture, a single engine at the heart of a corporation or government agency. With the development, however, of microchips and personal computers in the

1980s, computational power was redistributed. While data centers were still needed to accommodate the operations of large-scale organizations, most individuals had all the power and storage they needed built into their own PCs.

This dynamic shifted again, however, at the turn of the twenty-first century, with the advent of cloud computing. As our digital demands exponentially expanded, the means to store and manage all this data moved from the confines of our own computers to the ever-expanding online. For example, rather than downloading music or video files, most consumers today stream media from third-party service providers, to which they pay subscription fees. They access applications ("software as a service") through web browsers as often as they download them. And rather than cull proliferating photos and documents to fit within the limitations of their own hard drives, they purchase real estate for all that data in the cloud. Tom Boellstorff aptly describes this recentralization of computational resources as a "return to the mainframe in virtual form" (2010, 5). Data centers are essential architecture in this new arrangement.

Today, data storage is a $50 billion industry.[3] At the time of my research it was estimated that there were over three million data centers in operation (Carruth 2014), and more were being constructed around the world at a rate increasing by 15 percent every year (Hogan 2018). The utility of these numbers is limited, however, by the expansive variety of operations and facilities. A server room in a corporate office counts as a data center. So, too, does the China Mobile facility in Hong Kong, the world's largest data center at the time of this writing, clocking in at 7.7 million square feet. Another way, then, of understanding the scale of data storage is attending to what those data centers store. The International Data Corporation, a market research firm, estimated the collective sum of global data at thirty-three zettabytes (ZB; one zettabyte is equal to one sextillion bytes) in 2018. It also predicted this number would grow to 175 ZB by 2025, with the majority of this data stored in data centers.[4] Yet another metric for measuring data centers is by the electricity they consume. A moderately sized ten-megawatt data center uses about as much energy as 5,000 homes. Meanwhile, the world's most power-hungry data center currently uses 150 megawatts a year. Taken together, data centers accounted at the time of my research for 416 terawatt hours, or roughly 3

percent of all power generated worldwide.[5] Or, as the environmental organization Greenpeace put it, if the cloud were a country, its energy consumption would be the fifth largest in the world.[6]

These figures—and the way they feed into a growing network of international infrastructures and industries[7]—position data storage as an increasingly urgent object of inquiry. They also lead me to propose two analytic shifts: first, from an emphasis on data flow to data *fixity,* and second, from a focus on data's contents to data's *forms.*

Contemporary imaginaries of data are defined by motion: from the idea that communicative connection "compresses space-time" to the oft-quoted adage that "information wants to be free." Speed is our primary metric for understanding internet access, and much of data's transformative potential is understood in terms of its ability to travel across traditional borders and boundaries. In Iceland, telecommunications are often described as "arteries" or "life veins" (*lífæð*) of society, calling up a ceaseless, circulatory churn (Bjarnason 2010). Meanwhile, the English-language metaphor of "streaming" suggests the "continuous, uninterrupted processuality of data transmission" (Denecke 2020) and imbues this transmission with a bucolic, riverine quality. Tapping into Enlightenment-era ideals of a world in motion (Mattelart 2000), data is most often understood as mobile, meaningful not in its mere existence but for the fact of its unhindered flow.

Data centers, however, complicate this common sense. As facilities where data stops and tends to stay awhile, data centers instantiate a kind of stasis as essential as the cloud's many mobilities. While immobility in relation to infrastructure often signals its failure or breakdown, in the case of distributed computing it is a feature rather than a bug. In fact, storage is integral to the way our informational lives are organized, and it has been for quite some time. Media theorist Friedrich Kittler, for example, conceptualized the paper book's innovation as harnessing "unstorable data flows," and that of the gramophone as its disruption of "writing's storage monopoly" (1999 [1986], 9, 70). Storage emerged as a central concern for the cyberneticians of the 1950s and '60s, who dreamed of a total database of information but worried over the practicalities of access (Halpern 2015). And disk storage, located in the hard drive since the 1980s, has since been read as a key metric for advances in computational technology (Kirschenbaum 2012).