# Thinking Beyond Fairness: Applying Abolition Ecologies to Data

Amelia Lee Doğan
*Information School*
*University of Washington*
Seattle, WA, USA
dogan@uw.edu

***Abstract*—In the realm of Public Interest Technology, grappling with data challenges has become paramount. Questions surrounding the implications of living in a world dominated by Big Data, along with concerns about whose data fuels new AI models have catalyzed the growth in the field of critical data studies and fairness. This growth aims to ameliorate the effects of emerging technologies and their data usage. As technology practitioners, we aim to create a better world with technology, one that does not reinforce the systems of oppression already present in our current world. Much of the literature concerns how to mathematically define fairness with regards to race and gender. Moreover, critical literature tells us systems of oppression do not operate only on a technical, mathematical level. Systems of oppression are interconnected and interdependent and do not only affect humans, but also the environment, climate, and beings around us. Drawing on data justice theories, I examine how data feminism and Indigenous data sovereignty provides us with glimpses to how we consider *embodied data*. Rather than considering just the societal effects of data, I introduce data geography, an abolition ecology way of weaving social science and critical data studies together to merge public interest considerations of how data affects the land and us, human beings. I then walk through a case study with the Utah Data Center of how an abolition ecology way of thinking about data might make us more sensitive to think about technology in real, embodied spaces.**

## I. Introduction

In 2020, Google publicly humiliated and fired Dr. Timnit Gebru, from the Ethical AI Team [1]. Her dismissal sent shockwaves through the tech industry across the United States. Dr. Gebru, a celebrated Black woman studying the real-world impacts of AI and Big Data, forced a reckoning about sexism and racism rampant in the field. The paper that allegedly caused Dr. Gebru's dismissal questioned the ethicality and impacts in natural language processing including the "environmental and financial cost," along with racial bias and accessibility of big models [2, p. 610]. Dr. Gebru sought to expose Silicon Valley's efforts to "erase both its own past and its connection to the material world" [3, S26]. The firing of Dr. Gebru speaks to how technology companies and the industry reacts to a black woman raising questions around access and environmental justice in computing.

Dr. Gebru's most famous work, a paper co-authored with researcher Joy Boulamwini, another Black woman focused on ethical technology, audited and found that commercial facial recognition disproportionately could not recognize dark-skin black women [4]. The paper is considered a foundational text in the field of critical data science. In a recent paper introducing and formalizing the term critical data studies, the authors proposed three key principles that the field deals with: "the identification of social data problems, the design of critical frameworks for addressing social data problems, and the application of social solutions to increase data literacy" [5]. Lost in this definition of critical data studies are specific citations of other critical theories concerning race, gender, the environment, ability, queerness, and more. These social theories focused on race, gender, and other identities have proved fundamental in shaping fields such as critical race theory in legal studies [6, p. 4] and should inform critical data studies as well. Following this tradition, I seek to bring works on race, gender, and the environment together with critical data studies and PIT. In designing critical frameworks for data science, I must look to other fields that have built much more on previous critical theories such as critical geography, feminisms, and queer studies.

To build a framework for critical data studies, I turn in this paper to understand the ecological and environmental works in computer science. I will use the specific case study of the quiet, non-descript data centers and warehouses part of the internet infrastructure and Cloud in the United States. These places are of particular analytical interest because the general public often remains unaware of the "squat, windowless… typology of warehouses and office parks that make up today's postindustrial landscape" [7, p. 73]. In making the data center visible, I will introduce data geography, an applied abolition ecologies framework to further show the linkages between critical geographies, political ecology, and critical data studies.

## II. The Ecological Impact of Data Centers

Data centers are located throughout the continental United States [8] in an effort to improve latency and computing speeds for users around the country. Many companies publicly publish locations of their data centers and cloud computing warehouses, but many data center companies also "keep the map secret... to serve as an effective security barrier" [7, p. 69]. There are also many more data centers across the United States that belong to the American military and defense agencies

This material is based upon work supported by the National Science Foundation under Grant No. DGE-2140004

scattered in people's backyards and neighborhoods. Even if all the data warehouses across the country could be mapped, that would be insufficient in thinking about the local context necessary in PIT.

For a moment though, zoom out and consider the digital economy's ecological impact on a large scale. These ecological impacts include water usage, mining, and electrical needs to power the industry [3, S10]. For example, in a decade some experts predict data centers will use more energy globally than Japan and Germany combined [9, p. 19]. These predictions are concerning when quantified globally the cloud remains one of the largest consumers of coal energy [7, p. XXV]. In fact, a 2013 report sponsored by the National Mining Association and American Coalition for Clean Coal Energy markets the cloud as being an integral part of the coal energy market [9]. Together, the physical manifestation of the digital economy "[f]rom Bitcoin 'mines' to server 'farms' to data 'warehouses," the places and processes… look surprisingly similar to those found in more traditional forms of industrial manufacturing" [3, S10]. Rather than accepting a clean techno-utopia framing of the digital world, an important understanding lies in accepting the real environmental consequences of a digital world.

Besides just academic quantifications of environmental harms of data centers, the US mainstream media has extensively reported on the issue. However, the media when looking at the cloud or data centers ignores the connection between environmental justice, the fight for disenfranchised communities to have protection and control over their environment [10], and racial capitalism, how "predominantly white institutions use nonwhite people to acquire social and economic value" [11, p. 2152]. For example, Burrington notes in a 2015 article in *The Atlantic* that "companies increasingly foreground this sustainability information when engaging with journalists demonstrates a growing public interest in The Cloud's environmental impact" [12]. Nevertheless, she dismisses questions of racial capitalism and ecological impact saying that "if the energy used by a computational process is renewable, energy consumed by that process isn't that big of a deal" [12]. Similarly, 2012 reporting on diesel generators used in a Microsoft data center in Sinkiuse land (Quincy, Washington) near Mountain View Elementary School [13], failed to note Mountain View Elementary is a majority Hispanic and over 60% of students qualify for free or reduced lunch [14]. The dimensions of racial capitalism and environmental justice can not be ignored in the ecological analysis of data centers. The lack of analysis around racial capitalism, settler colonialism, and ecological relations in environmental works on computing shows the underdevelopment of critical theories in the field.

## III. Data Justice

Over the past twenty years, concerns about equity and intersectionality in so-called "Big Data" and AI have come to the forefront of consciousness around how computing plays a large role in everyone's lives. Many theories in critical data studies have arisen about how to handle data around how oppressed and marginalized groups can be better represented and play a role in their own data. These frameworks, called data justice, help address concerns about race, gender, and power in computing and critical data science. Yet, still data justice often ignores ecological ramifications. I will focus on the lack of tangibility of data's ecological impacts in two data justice frameworks: data feminism and Indigenous data sovereignty.

Data feminism is a term and theory coined by Catherine D'Ignazio and Laura Klein presented in their 2020 book [15]. The theory seeks to create "a way of thinking about data, both their uses and their limits, that is informed by direct experience, by a commitment to action, and by intersectional feminist thought" [15, p. 8]. D'Ignazio and Klein use a strong theoretical background building on Black feminist Patricia Hill Collins' matrix of domination [15, p. 24] to create their seven central tenets of data feminism: examining power, challenging power, elevating emotions and embodiment, rethinking binaries and hierarchies, embracing pluralism, considering context, and making labor visible [15, pp. 17–18]. Their focus on human emotion and embodiment consists mainly of analyzing data visualizations and a map, yet the chapter on embodiment fails to acknowledge the physicality of computing data, the viscerality of data warehouses, and their subsequent environmental effects. The only real negotiation of data's physical manifestation is in D'Ignazio's and Klein's discussion of Potawatomi cartographer Margaret Pearce's "Coming Home to Indigenous Place Names in Canada," a map of indigenous place names collected from First Nation, Metis, and Inuit communities [15, pp. 92–93]. In this map, Pearce clearly articulates that place names are "Indigenous cultural property" [15, p. 92] and not data that is stored on a server somewhere. However, in articulating that this physicality of data is stored in indigenous peoples and their lands, Klein and D'Ignazio fail to comment on how other data is embodied and stored. Data feminism, like many other data justice frameworks, provides many important lessons and theories for dealing with data's outputs and projects, but Klein and D'Ignazio fall short on the embodied data, the reckoning with the *embodied data* in actual *places* and *warehouses* data is stored in.

Moving to another data justice theory, I examine indigenous data sovereignty which "centres on collective rights to data about our peoples, territories, lifeways and natural resources and is supported by Indigenous peoples' inherent rights of self-determination and governance over their peoples, country and resources" [16, p. 236]. The need for indigenous data sovereignty is rooted in historical indigenous statistical and data traditions [17, pp. 11–12] and the continued deficit model used in current colonial statistical collection methods about indigenous people [16, p. 235]. In the United States, much of the concerns in case studies about data sovereignty look at the multitude of data sources, complications with the United States Census, and difficulties of tribal governments accessing data about their own people and land [18]. Even if data exists and is accessible for governance, the data may not be of use to tribes who seek to collect data that "reflect indigenous social

structures, realities, or aspirations" [19, p. 261]. Even when the literature concerns tribes at the forefront of the data revolution, there is little literature about on-the-ground practices of storage and collection of the tangible embodied data.

While Indigenous data sovereignty explicitly concerns ecological and environmental data in theory and practice [17, pp. 11–12], there is little discussion of the impact of *embodied data* on the environment, land, and water. Indigenous data sovereignty is not only a theoretical foundation [19]. It's actively practiced like at Kahnawá:ke Education Council's data management system [20, p. 1] and how many First Nations in Nova Scotia partner with indigenous Membertou Data Centre [20, p. 5]. In these cases, the first step towards Indigenous data sovereignty means gaining access to technical architecture that "must be secure, scalable, customizable, and interoperable" [20, p. 8]. When describing Kahnawá:ke's technical architecture the authors highlight secure networks, data management tools, and digital teaching tools, but they don't mention the data architecture's environmental impacts [20, p. 8]. Further, when speculating about future considerations for the Kahnawá:ke Education Council the study fails to consider the role of the environment, land, and water in the data management system and storage [20, p. 15]. If Indigenous data sovereignty is to strengthen tribal sovereignty and widen Indigenous worldviews then environmental and ecological questions must be asked.

In these two case studies of data justice frameworks, there is a lack of attention paid to embodied data and its ecological consequences. Data feminism has the opportunity to address these ecological questions by deepening its analysis of embodiment beyond just the humans who interact and produce the data but also the data embodied in space [15, pp. 73–96]. Alternatively, Indigenous data sovereignty as a tool of Indigenous resurgence to "counter settler colonialism and enact self-determination" [20, p. 3] must not only include ecological and environmental data but grapple with the inherent settler colonialism of current data warehouses and storage methods. Indigenous data sovereignty can grapple with these questions through practical projects that are already occurring across Turtle Island from the Membertou Data Centre to local data storage options [21]. Synthesizing these theoretical considerations, I will propose a new direction for data justice to include ecological and environmental data impacts.

## IV. Theoretical Foundations

Abolition ecology was first introduced in a special issue of Antipode, a radical geography journal. The progenitors explained abolition ecology explicitly "seek[s] to enrich, expand and extend the logics (and thus possibilities) of the political ecology and environmental justice literatures with a capacious understanding of abolition geography" [22, p. 22]. However, many of the articles from the special issue of Antipode on abolition ecology look specifically at prisons [23], environmental movements [24], and Indigenous solidarity [25]. The literature on computing warehouses and their associated environmental and ecological impacts in relation to settler colonialism and racial capitalism remains under examined by abolition ecology practitioners.

In traditional work on the ecological cost of the cloud, traditional capitalistic and environmental measures are used. For example, a series of researchers at Microsoft when considering the "cost of the cloud" used a simple monetary breakdown associated with data centers such as server, infrastructure, power, and network cost [26, pp. 68–70]. Their analysis entitled "The Cost of a Cloud: Research Problems in Data Center Networks" makes no note of ecological or environmental costs associated with the production or implementation of servers or power. Even when researchers consider the environment explicitly, they focus simply on percentage decreases such as finding that "energy density of global data centers have decreased by 20% annually since 2010" [27, p. 985] and traditional metrics of energy efficiency like Energy Star and governmental policy [27, pp. 985–986]. In the rare cases, researchers take into account critical data studies they suggest traditional data justice methods like the possibility of "public data and modeling capacities… for understanding and monitoring data center energy use and its drivers" [27, p. 986]. These suggestions fall in line with current literature on data feminism and Indigenous data sovereignty, not considering more radical and critical public interventions into data.

Simultaneously, geographers of the cloud such as Louise Amoore when expanding on the cloud geography miss the ecological impact of grounding the cloud. Amoore in her analysis of cloud geography moves from Cloud I, defined as the concern with "the identification and spatial location of the data centres where the cloud is thought to materialize" [28, p. 7] to Cloud II, where cloud geography is "a novel political space of calculative reasoning" [28, p. 12] . Cloud II fails to consider abolition ecology because of Amoore's focus on nonspecific, trans-national, and vague examples which fail to reflect on Ruth Wilson Gilmore's specificity in "freedom as place" [29]. Rather, I propose a theory of data geography to encompass both cloud geographies to consider how data is stored, processed, and analyzed.

## V. Moving Towards Data Geography

Data geography at its core asks about the ecological questions around tangible and embodied data. It does not accept the abstraction of the cloud or computing but insists on the real-life physicality of where and how the data is being stored and processed. Data geography is concerned with the entire lifecycle of data from collection, storage, processing, and end use. Data geography also comfortably sits within fields like environmental computing and critical data studies with concerns around technical infrastructure and tangible data. A push for data geography will also hopefully encourage other data justice frameworks to incorporate ecological and environmental measurements in their theoretical foundations.

With the theoretical foundations of data geography laid out, I will now move to apply data geography to an already critically studied case study, the Utah Data Center, to show how data geography could expand the field. Just south of Salt

Lake City, in Bluffdale, the Utah Data Center, a series of low-slung warehouses owned by the National Security Agency (NSA), lies off Camp William Road [30]). Most journalists, especially after the Edward Snowden revelations, wrote about and were concerned with the contents of the data stored in the Utah Data Center– most likely everything from personal text messages to stock trades to any possible electronic communication [31]. These holdings are especially relevant as they deal also with the historical militarization of the cloud [7] and abolition ecology questions around the American government's carceral and militaristic move towards hyper-surveillance of the populace. The use of massive collections of personal networked data, both encrypted and unencrypted, sits in the larger framework of data's role in abolition and concerns data geography. However, only dealing with the data's contents and government surveillance fails to ask many critical questions about the Utah Data Center.

Rather, when applying questions of data geography to the Utah Data Center ecological and economic questions of *embodied data* come to the foreground. Mél Hogan gives an incisive data geography view on the Utah Data Center's effort to procure its 1.7 million gallons of water per day [31] through an agreement with Bluffdale where "the city sold water at rates below the state average in exchange for the promise of economic growth that the new waterlines paid for the NSA would purportedly bring to the area" [32, p. 6]. This new economic growth though seems focused on internships with college students through the University of Utah [30] and not working class people. Data geography questions the decisions made by the city of Bluffdale to procure such large amounts of water at a discounted rate in the dry state of Utah. Other ecological questions posed by data geography would center on how traditional lands of the Ute, Paiute, and Goshute people became the place of choice for a settler government surveillance storage facility. This would require answers including why data centers are often placed in rural areas where they may "call less attention to themselves and risk less pushback" [32, p. 4] and why Utah has such cheap electricity [30]. A data geography case study would also document local resistance to the Utah Data Center by groups like Restore the Fourth, a group focused on combating government surveillance, who adopted part of the highway leading to the facility [32, p. 7]. The Utah Data Center provides a ripe case study for future PIT scholars who seek to explore questions posed by data geography.

## VI. Conclusion

By expanding data justice frameworks to incorporate ecological perspectives on embodied data, my aim is to render the cloud tangible and prevent it from remaining a "silent… mute piece of infrastructure" [7, p. ix]. These silent and mute pieces of the environment have real consequences for local economies, water sources, and air quality. I propose data geography where racial capitalism and settler colonialism with abolition geography are directly applied to environmental computing studies. Instead of the cloud and data centers being "everywhere and nowhere" [3, S15], I ensure that data justice frameworks insist on the "somewhere" of data and computing. The work of data geography, though theoretically formulated here, is already practiced by scholars like Timnit Gebru and Mél Hogan.

Given that abolition ecologies has only recently been formalized as a field [22], there is an opportunity to expand the current literature on abolition ecologies from prisons and grassroots environmental justice to also include data centers and warehouses. Abolition ecology proves a fruitful sibling for data geography since current data justice frameworks lack consideration of data's tangible environmental and ecological impacts. In being informed by critical data studies and data justice, I draw on varied literature to insist upon the *tangible, embodied,* and *physical* manifestation of data in conjunction with data's relations with humans, lands, and other organisms. Data geography presents a portal to consider data, society, public interest technology, and the ecological world all at once.

## References


[1] K. Ho, *We read the paper that forced Timnit Gebru out of Google. Here's what it says.* en, Dec. 2020. [Online]. Available: https://www.technologyreview.com/2020/12/04/1013294/google-ai-ethics-research-paper-forced-out-timnit-gebru/.

[2] E. M. Bender, T. Gebru, A. McMillan-Major, and S. Shmitchell, "On the Dangers of Stochastic Parrots: Can Language Models Be Too Big?" en, in *Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency*, Virtual Event Canada: ACM, Mar. 2021, pp. 610–623, ISBN: 978-1-4503-8309-7. DOI: 10.1145/3442188.3445922. [Online]. Available: https://dl.acm.org/doi/10.1145/3442188.3445922.

[3] N. Ensmenger, "The Environmental History of Computing," en, *Technology and Culture*, vol. 59, no. 4S, S7–S33, 2018, ISSN: 1097-3729. DOI: 10.1353/tech.2018.0148. [Online]. Available: https://muse.jhu.edu/article/712112.

[4] J. Buolamwini and T. Gebru, "Gender shades: Intersectional accuracy disparities in commercial gender classification," in *Conference on Fairness, Accountability and Transparency, FAT 2018, 23-24 February 2018, New York, NY, USA*, S. A. Friedler and C. Wilson, Eds., ser. Proceedings of Machine Learning Research, vol. 81, PMLR, 2018, pp. 77–91. [Online]. Available: http://proceedings.mlr.press/v81/buolamwini18a.html.

[5] A. Iliadis and F. Russo, "Critical data studies: An introduction," en, *Big Data & Society*, vol. 3, no. 2, pp. 1–7, Dec. 2016, ISSN: 2053-9517, 2053-9517. DOI: 10.1177/2053951716674238. [Online]. Available: http://journals.sagepub.com/doi/10.1177/2053951716674238.

[6] R. Delgado and J. Stefancic, *Critical race theory: an introduction*. NYU Press, 2017.

[7] T.-H. Hu, *A prehistory of the cloud*. Cambridge, Massachusetts: The MIT Press, 2015, ISBN: 978-0-262-02951-3 978-0-262-52996-9.

[8] TeleGeography, *Cloud Infrastructure Map*. [Online]. Available: https://www.cloudinfrastructuremap.com/#/service/cloud-regions (visited on 04/02/2021).

[9] M. Mills, "The Cloud Begins With Coal: Big Data, Big Networks, Big Infrastructure, and Big Power," Digital Power Group, Tech. Rep., Aug. 2013. [Online]. Available: https://www.tech-pundit.com/wp-content/uploads/2013/07/Cloud_Begins_With_Coal.pdf.

[10] *What is Environmental Justice?* en-US, Detroiters Working for Environmental Justice. [Online]. Available: https://detroitenvironmentaljustice.org/what-is-environmental-justice/ (visited on 05/15/2021).

[11] N. Leong, "Racial Capitalism," *Harvard Law Review*, vol. 126, no. 8, pp. 2151–2226, Jun. 2013. [Online]. Available: https://harvardlawreview.org/2013/06/racial-capitalism/.

[12] I. Burrington, "The Environmental Toll of a Netflix Binge," *The Atlantic*, Dec. 2015. [Online]. Available: https://www.theatlantic.com/technology/archive/2015/12/there-are-no-clean-clouds/420744/.

[13] J. Glanz, "Data Centers in Rural Washington State Gobble Power - The New York Times," *New York Times*, Sep. 2012. [Online]. Available: https://www.nytimes.com/2012/09/24/technology/data-centers-in-rural-washington-state-gobble-power.html.

[14] C. P. S. D. 2.-2. S. Year, *Mountain View Elementary Common Core Data*, 2020. [Online]. Available: https://nces.ed.gov/ccd/schoolsearch/school_detail.asp?Search=1&InstName=mountain+view+elementary+&State=53&SchoolType=1&SchoolType=2&SchoolType=3&SchoolType=4&SpecificSchlTypes=all&IncGrade=-1&LoGrade=-1&HiGrade=-1&ID=530708001053.

[15] C. D'Ignazio and L. F. Klein, *Data feminism* (Strong ideas series). Cambridge, Massachusetts: The MIT Press, 2020, ISBN: 978-0-262-04400-4.

[16] M. Walter and M. Suina, "Indigenous data, indigenous methodologies and indigenous data sovereignty," en, *International Journal of Social Research Methodology*, vol. 22, no. 3, pp. 233–243, May 2019, ISSN: 1364-5579, 1464-5300. DOI: 10.1080/13645579.2018.1531228. [Online]. Available: https://www.tandfonline.com/doi/full/10.1080/13645579.2018.1531228.

[17] T. Kukutai and J. Taylor, Eds., *Indigenous Data Sovereignty: Toward an agenda*, English. Australian National University Press, 2016, OCLC: 1004185625, ISBN: 978-1-76046-030-3. [Online]. Available: http://www.doabooks.org/doab?func=fulltext&rid=20455.

[18] C. M. Snipp, "What Does Data Sovereignty Imply: What Does It Look Like?" English, in *Indigenous Data Sovereignty: Toward an agenda*, T. Kukutai and J. Taylor, Eds., OCLC: 1004185625, Australian National University Press, 2016, pp. 39–55, ISBN: 978-1-76046-030-3. [Online]. Available: http://www.doabooks.org/doab?func=fulltext&rid=20455.

[19] D. Rodriguez-Lonebear, "Building a Data Revolution in Indian Country," English, in *Indigenous Data Sovereignty: Toward an agenda*, T. Kukutai and J. Taylor, Eds., OCLC: 1004185625, Australian National University Press, 2016, pp. 253–272, ISBN: 978-1-76046-030-3. [Online]. Available: http://www.doabooks.org/doab?func=fulltext&rid=20455.

[20] R. McMahon, T. LaHache, and T. Whiteduck, "Digital Data Management as Indigenous Resurgence in Kahnawà:ke," en, *International Indigenous Policy Journal*, vol. 6, no. 3, Jun. 2015, ISSN: 1916-5781. DOI: 10.18584/iipj.2015.6.3.6. [Online]. Available: https://ojs.lib.uwo.ca/index.php/iipj/article/view/7469.

[21] Animikii, *Demystifying Digital Storage Solutions for Indigenous Data Sovereignty*, en, Nov. 2019. [Online]. Available: https://www.animikii.com/news/demystifying-digital-storage-solutions-for-indigenous-data-sovereignty.

[22] N. Heynen and M. Ybarra, "On Abolition Ecologies and Making "Freedom as a Place"," en, *Antipode*, vol. 53, no. 1, pp. 21–35, Jan. 2021, ISSN: 0066-4812, 1467-8330. DOI: 10.1111/anti.12666. [Online]. Available: https://onlinelibrary.wiley.com/doi/10.1111/anti.12666.

[23] M. Ybarra, "Site Fight! Toward the Abolition of Immigrant Detention on Tacoma's Tar Pits (and Everywhere Else)," en, *Antipode*, vol. 53, no. 1, pp. 36–55, Jan. 2021, ISSN: 0066-4812, 1467-8330. DOI: 10.1111/anti.12610. [Online]. Available: https://onlinelibrary.wiley.com/doi/10.1111/anti.12610.

[24] M. Ranganathan and E. Bratman, "From Urban Resilience to Abolitionist Climate Justice in Washington, DC," en, *Antipode*, vol. 53, no. 1, pp. 115–137, Jan. 2021, ISSN: 0066-4812, 1467-8330. DOI: 10.1111/anti.12555. [Online]. Available: https://onlinelibrary.wiley.com/doi/10.1111/anti.12555.

[25] L. Mei-Singh, "Accompaniment Through Carceral Geographies: Abolitionist Research Partnerships with Indigenous Communities," en, *Antipode*, vol. 53, no. 1, pp. 74–94, Jan. 2021, ISSN: 0066-4812, 1467-8330. DOI: 10.1111/anti.12589. [Online]. Available: https://onlinelibrary.wiley.com/doi/10.1111/anti.12589.

[26] A. Greenberg, J. Hamilton, D. A. Maltz, and P. Patel, "The cost of a cloud: Research problems in data center networks," *ACM SIGCOMM Computer Communication Review*, vol. 39, no. 1, pp. 68–73, Dec. 2009, ISSN: 0146-4833. DOI: 10.1145/1496091.1496103. [Online]. Available: https://doi.org/10.1145/1496091.1496103.

[27] E. Masanet, A. Shehabi, N. Lei, S. Smith, and J. Koomey, "Recalibrating global data center energy-use estimates," en, *Science*, vol. 367, no. 6481, pp. 984–986, Feb. 2020, Publisher: American Association for the Advancement of Science Section: Policy Forum, ISSN: 0036-8075, 1095-9203. DOI: 10.1126/science.aba3758. [Online]. Available: https://science.sciencemag.org/content/367/6481/984.

[28] L. Amoore, "Cloud geographies: Computing, data, sovereignty," en, *Progress in Human Geography*, vol. 42, no. 1, pp. 4–24, Feb. 2018, Publisher: SAGE Publications Ltd, ISSN: 0309-1325. DOI: 10.1177/0309132516662147. [Online]. Available: https://doi.org/10.1177/0309132516662147.

[29] R. W. Gilmore, "Abolition Geography and the problem of Innocence," in *Futures of Black radicalism*, G. T. Johnson and A. Lubin, Eds., London ; New York: Verso, 2017, ISBN: 978-1-78478-758-5.

[30] R. Carroll, *Welcome to Utah, the NSA's desert home for eavesdropping on America*, en, Section: US news, Jun. 2013. [Online]. Available: http://www.theguardian.com/world/2013/jun/14/nsa-utah-data-facility.

[31] J. Bamford, "The NSA Is Building the Country's Biggest Spy Center (Watch What You Say)," en-US, *Wired*, Mar. 2012, ISSN: 1059-1028. [Online]. Available: https://www.wired.com/2012/03/ff-nsadatacenter/.

[32] M. Hogan, "(Another) Battle in the Clouds," en, *The Goose*, vol. 16, no. 1, pp. 1–4, 2017.