Cloud Ecologies: An Environmental Ethnography of Data Centers
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ABSTRACT

This dissertation is a multi-sited ethnography of cloud computing infrastructures and their wider environmental impacts in the northeastern and southwestern United States, Puerto Rico, and Singapore. Informed by participant observation among technicians and ethnographic engagement with the wider communities where data centers are sited, I situate the Cloud's material, political, economic, and social resonances as local rather than global in scope. What follows is a comparative reckoning of the Cloud's "metabolic rifts" (Marx 1863), defined by the particular geographic, climatic, economic, political, and social constraints and affordances in each of my field sites. Given that a significant portion of this fieldwork was undertaken during the height of COVID-19, the dissertation's chapters are interrupted by experimental vignettes I call "precipitations", which call for theoretical and methodological innovations amid pandemic lockdowns and the near-impossibility of human subjects research.

In Chapter I, *Cloud Temporalities*, I document the quotidian rhythms of maintenance, repair, and thermal management in data centers that in turn rehabilitate the masculine subjectivities of technicians. The 'emic' temporal formations of *uptime* (success) and *downtime* (failure), are linked to the *cold* that assures the former and the runaway *heat* that brings bout the latter. Through deep analysis of technicians' behaviors, speech patterns and discourses, I reveal how temporality (*uptime* and *downtime*), temperature (heat), and masculine expertise converge in data centers, introducing the terms "thermotemporalities" and "thermomasculinities". Chapter 2, *Cloud Clamor*, ethnographically reconstructs the sonic experiences of Arizona residents located in close proximity to data centers. I excavate a shared lexicon of physiological and psychic harms articulated by residents exposed to data center "noise pollution", tuned to wider sociopolitical disturbances amid the rise of "woke" and "anti-woke" discourses. I situate the experiences of Arizona residents within the larger history of noise regulation in the United States, linking their collective pursuit of "silence" to sonoracism and Allison Martin's concept of "sonic gentrification." Additionally, I introduce *settler acoustics*, a narrative complex in which the Sonoran Desert wilderness is repeatedly cast as "empty" and "barren" and is thusly figured as the preferred receptacle for the Cloud's sonic waste (over suburbia), despite settler histories of dispossession and the ongoing presence of indigenous communities there. In Chapter 3, *Cloud Hydraulics*, I contrast the extreme work environments in the arid data centers of Arizona to their humid counterparts in the tropics of Puerto Rico and Singapore, revealing a temperate bias that pervades computational design and practice. I trace the hydraulic practices I document in data centers to deeper histories of air conditioning, speleology, and architecture. I turn to figuration to narrate the hydraulic paradox of the Cloud as simultaneously hydrophilic and hydrophobic, as part of the hydrological cycle and vulnerable to the deluges precipitated by hurricanes. Inspired by the work of Mél Hogan and Stefan Helmreich, I introduce "limit ecologies" as a framework for apprehending cloud computing's turbulent expansion into submarine and extraterrestrial frontiers.

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Precipitation: YesterCloud

      The year is 1000 CE. Clouds flock along the ridges of the Andes mountains. They shed their dew to feed plots of maize, quinoa and potatoes that flourish along terraced slopes. A runner emerges from the mist, bearing something in their hands. An array of strings that droop like fingers. Some are knotted, others are colored with dye. To your trained eyes, these subtle variations are rich with meaning. You count the knots in the string, excavating the code hidden in this computer spun from fabric. In geometries of fiber, you find ledgers and legends, myths and maps, censuses and chronicles. For this is the khipu – the 'informatic' backbone of Andean civilization – and you are its interpreter, its quipucamayoc (Beynond-Davies 2007).
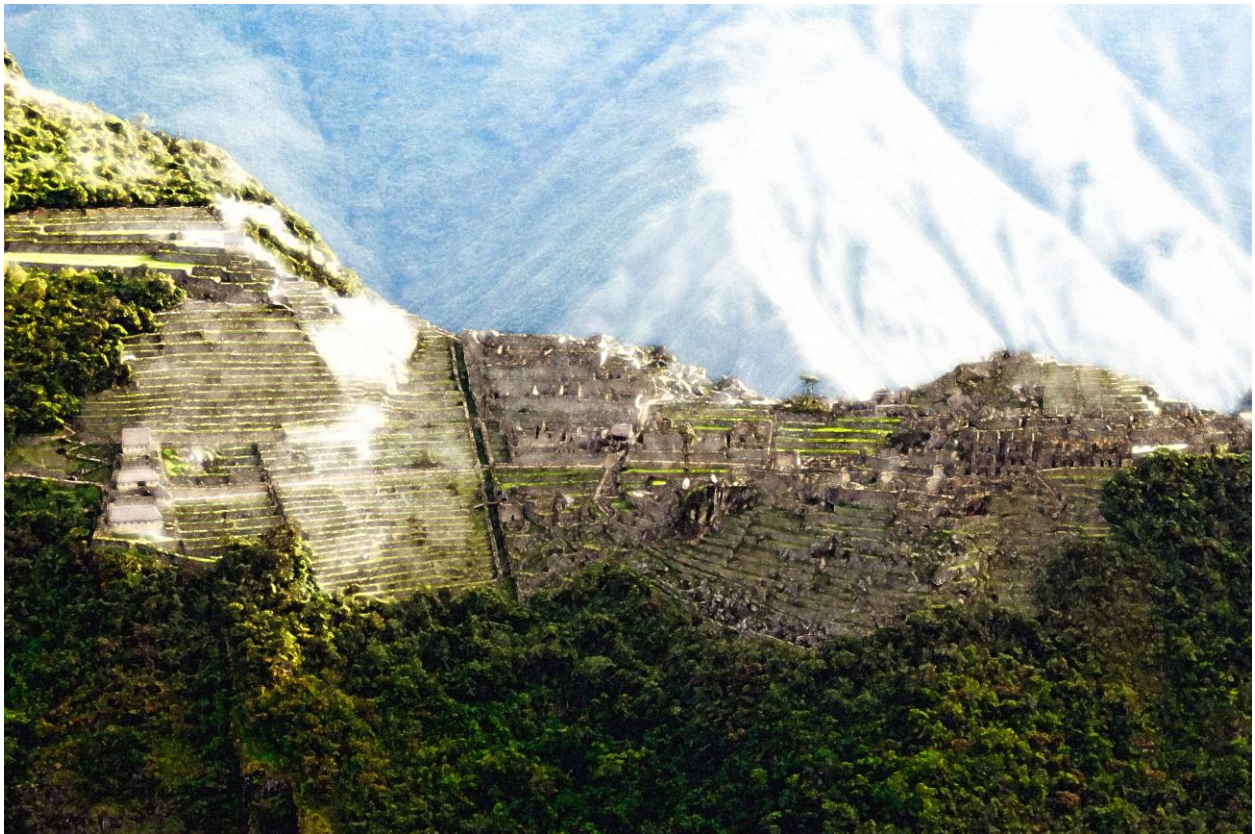
"Machu Picchu from Phutuq K'usi Mountain, Peru", Image: Dimitry B., CC BY 2.0

For millennia, the civilizations of the Andes relied on the computational prowess of the khipu to administer an empire that spanned thousands of kilometers in one of the most extreme and rugged landscapes on Earth (Ascher 1983; Beynond-Davies 2007; Davies 2007). But the khipu was but one cog in a well-oiled Andean information machine. Without the aid of cavalry or wheels to navigate the steep terrain of the Puna watershed, Andean empires thrived by creating a robust network infrastructure of human runners, roads, quipus, and their interpreters, the Quipucamayoc.
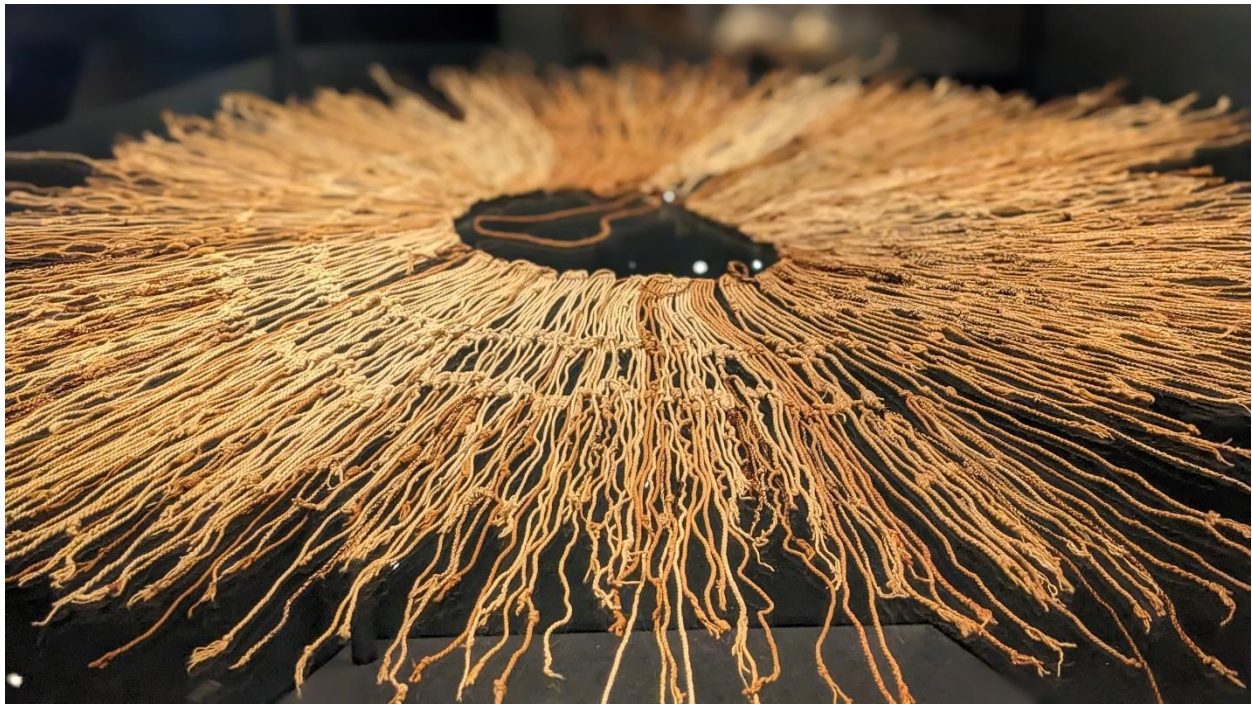
Khipu circa. 1400 CE , Gothenburg Museum of World Culture, Image: Author

Spooled together, this latticework of runners' bodies, roads, numbers, and fabrics, formed what might be the world's first Cloud. Spun from fabric rather than silicon, the informatic Cloud of Tawantinsuyu sustained a civilization of millions that at its apex encompassed a geographic area of over 4,000 kilometers.

The Andean Cloud, Diagram by Author

In 1583, colonial officials on the Third Council of Lima decreed that the khipu were a blasphemy against God (Bolton 2006). They banned their use and burned as many as they could find. Despite the Spaniards' brutal attempt to erase precolonial Andean history, enough of the khipukuna survived to tell us the stories of the ancient Andeans who wove them. Today, the khipu remains an important aspect of ceremonial life for contemporary Andean peoples (Hyland 2017).

A Quipucamayoc, Image: Felipe Guaman Poma de Ayala

The fact that so much of the Andean cloud has endured into the twenty first century is as remarkable as it is instructive. A khipu is made from woven delicate plant or camelid fibers. Astonishingly, many are still durable enough to hold in your hands, albeit with care. Like other textile artifacts, they must be preserved in climate-controlled environments to prevent the growth of microorganisms or molds that might degrade them (Greene 2005). Even so, that computers made of fabric could survive for centuries is humbling given that twenty-first century solid-state disk drives begin to decay within a decade (Kilbride 2015; Król and Zdonek 2020).

For all of our technological sophistication today, durability is not one of our strong suits. Bits rot. Powered by calories and fibers and interpretive labor, the khipu is only one of myriad ancient data preservation technologies far more durable and sustainable than our silicon-based computers.

On the opposite side of the Earth, Shang Dynasty-era healers etched writing onto the bones of animals. They applied flame to divine answers from the random cracks and fissures in the bone that heat carved. These ancient data storage devices, known as "oracle bones", date back to 1250 BCE (Schwartz 2020; Wang et al. 2022). Even more ancient are the cuneiform tablets of the Sumerians. Etched in clay in Mesopotamia over five thousand years ago, the tax records they contain are still legible to archaeologists and computational linguists (Matthews 2013).

These examples from the ancient world leave us with a simple question, why is our digital heritage so fragile? Some might say that the ephemerality of hard disks is an inevitability of design. An engineered tradeoff for greater storage capacity at the expense of durability. But as an Anthropologist, I believe that the answer is less about design and more about practice, a property of culture rather than a limit hard-coded by nature. Because technologies always reflect back the priorities and values of the cultures that shaped them.

Introduction: Nubecene

1000101011100101010101. Megawatt hours (Mwh). Tonnes of carbon dioxide equivalent (CO2e). Millions of litres of water (l). Kilograms of mineral and rare earth metals (kg). In excess of forty decibels (db) at frequencies within a range of 50-12oo Hertz. 2000 calories per day, (recommended).

Bits are metabolic. They are flickers of materiality, carried by photons and electrons and invisible waves, coursing through chips printed on silicon. Their processions and energetic "leaps" (Pasek et al. 2023, p. 19) belie a materiality, their "exhaust" warmth born of molecular "friction" (Starosielski 2021, p. 192). Anne Pasek narrates digital computation as an "energetics" (Pasek et al. 2023), tracing its history from analog "commercial information processing machines" to the digital computers that harness electrical flows as a "medium of calculation" rather than a mere "energy input" (Pasek 2023, p. 18):

The calculative work that would define the basis of digital computation first required the formalization of algorithmic code and symbolic logic. In so doing, electricity would shift from being an input to being a medium of calculation…Perhaps we don't linger long enough in the fact that digital programming developed from the material culture of electrical engineering…Circuits are at the material core of how…[digital] systems are built and executed; electricity is the medium of virtually all computational work today. (Pasek 2023, p. 18-19)

By "tracing digital energetics from the chip to the grid and back", Pasek roots computational materiality to electrons (Pasek 2023, p.10).

Electron flows are measured as energy. Joules. Watts. Calories? Cara New Daggett might trace this energy analytic back to nineteenth century Protestant capitalists, who reckoned "energy-as-work", a calculative device devised to more "efficiently" extract labor from machines and the human bodies that steered them (2019). Nathan Ensmenger might agree with

that analytic, arguing that digital infrastructure is the 'factory's successor' (2021). Whether we use calories, electrons, or watts, computation – both the digital and analog varieties – is inexorably linked to labor (Ensmenger 2012; Hicks 2017; Light 1999; Pasek et al. 2023), and as a result is thoroughly imbricated in capitalism (Hu 2015, Mosco 2015). Data centers are this iteration of capital's new "factories"(Ensmenger 2015), where computational work is "offshored" (Pasek 2023, p. 24), harvesting information, transforming data into a commodity (Mosco 2015) in a dynamic Mel Hogan calls "The Data Center Industrial Complex" (2021).

The environmental consequences of this sprawling computational infrastructure harnessed by digital capitalism, is the subject of this dissertation. If the bit or the electron is the most fundamental particle of digital capitalism, then data centers are its beating heart. Located on every continent, in every biome, threaded through a vast subterranean, extraterrestrial and "undersea network" (Starosielski 2015) of satellites, fiber optic cables, cellular towers, and data centers, is this fiction of immateriality many abbreviate as 'Cloud' (Hogan 2018). As scholarship of data centers reveals, the Cloud's materiality does not end with electrons; to sustain itself, it transubstantiates air (Johnson 2023) and water (Hogan 2015) and minerals (Cubitt 2015) and spews them out as heat (Starosielski 2021, Velkova 2016) and noise (Bosker 2018). I narrate this process as metabolism, borrowing MacKenzie Wark's reading of Marx's classic definition of metabolic rift: capitalism's tendency toward self-destruction, first in industrial scale farming that depleted soil nutrients, now on a planetary scale that invites a distinct cataclysm I name *Nubecene*. Distinct from the Anthropocene, Nubecene is less an epoch and more of a lens through which to reckon digital capitalism's particular footprint and its sociomaterial residues. It is a set of narratives of ecological transformations of material, political, economic, and symbolic varieties as Cloud expands.

This dissertation, *Cloud Ecologies*, is a collection of these narratives set in the Nubecene. Drawn from ethnographic fieldwork in and around data centers located in different continents, countries, and environments, the chapters offer something of an "ecologies of comparison" (Choy 2020) approach to narrating the Cloud's global and local environmental dynamics. Having conducted a majority of the fieldwork during the height of the SARS-CoV-2 , this dissertation provides some experimental interventions in the form of short reflective essays written in the field that I call "precipitations".

The first chapter, "Cloud Temporalities", draws on multiple field sites to establish linkages between temporality, thermodynamics, and masculinity in the data center workplace, "performative" genres of speech and behavior that I call "thermomasculinities" and "thermotemporalities" respectively. Uptime, a state of masculinized homeostatic chill, is counterposed to downtime, a state of feminized cataclysmic heat. In the second chapter, "Cloud Clamor", I draw on fieldwork in Chandler, Arizona to narrate residents' encounters with data center "noise" in their community, reframing their experiences within wider histories of "noise" and sound in the American context. I introduce the term "settler acoustics" to describe the racial dynamics and historical erasures embedded in their claims of sonic harm and their grievances against digital capitalism. In the third chapter, "Cloud Hydraulics", I contrast the material constraints and politics of water use in the "desert" data centers of the Southwestern United States with the "tropical" data centers of Puerto Rico and Singapore. I use the framework of "limit ecologies" (Helmreich 2011) to link computing's temperate bias to colonial histories and futures.

Precipitation: The Field is a Cloud

The evenings are quiet in the lockdown. In Puerto Rico, where authorities have enforced a 9pm curfew, where mobiles blaze and blare with the emergency alert system at 8:30 and then again at 8:59 to inform us that we must shelter-in-place to stop the spread of coronavirus. We comply. We retreat. And I take the time to reflect on my successes and failures for the day. My varied attempts to arrange meetings with folks working in infrastructure, in a time when meeting at all is morally questionable. I am even less successful in my attempts to elicit ZOOM meetings or phone calls. Puerto Ricans like their face-to-face interactions. Perhaps that's why the political slogans always depict their faces and torsos, unlike in the US, where a simple surname in white font with a red or blue background will suffice. I am successful at arranging numerous one-off meetings, often outdoors, where I am given a tour of a power plant or a wind farm or a data center, but the embedding stops there. My requests to hover, to linger, to stall, are denied or ignored. "Deep hanging out" is impossible when hanging out at all is unsafe. There doesn't seem to be a vaccine on the horizon, no matter what President Trump says in a Presidential debate. We are on our own. Masks and quarantines are our only defense against this invisible siege. But how can I do the work of ethnography? How can I deeply embed in a community when embedding itself is hostile? Anna Tsing and others have celebrated patchwork ethnography as a method. Others still naively tout the merit of fully virtual ethnography, as if ZOOMing isn't a privilege, a self-selecting, self-stratifying method of interaction that forecloses as much as it affords.

Perhaps I am cynical or frustrated or stir-crazy or all of the above. Or perhaps we have always been deluded that the field is anything but a construct. A fantasy of a bounded frame we use to make empirical arguments about the natures and essences of the communities we spend our time with. Just as culture, once a bedrock concept of our enterprise, was demoted in the wake of so many critiques. Is the field, too, withering? Or perhaps there never was a field. Like culture, the field is diffuse. The bounds of the frame always shifting, always expiring, even as we try to order them. Like culture, the field is a cloud. A protean shape. Ever-shifting. Deliquescing, morphing, evolving and devolving. It has no clear

beginning or ending – its parameters artificial. Like children we look up into the sky of our data and tease out familiar shapes or outlines, but instead of elephants or sailboats, we see romantic subalterns raging against the machine of so many compounding isms amid the backdrop of an equally complex salad of cenes. The field was always a cloud. Morphologically diffuse. A network of pooled images, quotations, field impressions, and artifacts that strive to say something coherent from the chaotic cauldron of our subjective record. Empirics, as Haraway famously argued, are always situated. And so many different clouds might bubble up from the cauldron of our data (Haraway 1988). But we must choose one. Whichever is most coherent, empirically substantiated, or aesthetically pleasing, or perhaps thematically resonant with whatever is trending in the hottest publications or twitter threads. In a way, the dissolution of the field is liberating. It's better to be patchy than to grasp at air for solids that are already melting (Marx 1867).

- Field Note Excerpt: 12th of November, 2020.

I - Cloud Temporalities

Heat synch[1]

Media's materiality is composed and recomposed in relation to shifting temperatures.

—Nicole Starosielski (2016: 294)

"Before containment, the data center was a chaotic place," a data center technician says to me, straining to be heard over the mechanical din of roaring servers.

We stand beneath the crystalline dome of a containment structure my interlocutors refer to as "gable C3." Within this pressurized glass container, refrigerated air seeps upward from the raised-floor plenum beneath my feet, riffling through tiny perforations in specialized floor tiles. The ingress of cold air is palpable on my skin, causing me to shiver. A trained ear can discern when the miniature fans inside of the computers are revving up to compensate for rising temperatures. Heat sinks grafted onto server circuit boards soak up the waste energy of computation, exchanging heat with flowing air molecules to keep component temperatures stable. Without the cooling supplied by industrial scale air conditioners known as CRACs (Computer Room Air Conditioners), however, the fluid medium of air warms quickly, and the fragile operations of transistors destabilize as electrons become unruly. It is for this reason that the server exhaust ports face away from us, Tom Haines, my guide to this glass world, explains. The aisle beyond the gable in which we are standing is hot with the air of server exhaust. Such is the configuration of the entire facility, an alternating pattern of containerized cold aisles and open hot aisles to vent server exhaust. This is an approach to climate control in data centers

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[1] A version of this chapter was published as an article in *New Media & Society*: Gonzalez Monserrate, Steven. "Thermotemporalities, thermomasculinities: Uptime, downtime, and server heat in the digital Anthropocene." *New Media & Society* 25, no. 2 (2023): 324-344.

called "cold aisle containment" . Containment optimizes HVAC (heating, ventilation, air

conditioning) efficiency by minimizing the mixture of cold and warm air over server racks.

"No matter the intensity of the IT load—payroll, online gaming, crypto—containment

will keep the heat at bay 24/7/365," Tom says gesturing to the servers twinkling asynchronously

around us. "Time moves differently here, the data center is like a city that never sleeps . . . and

heat, heat is the only thing that *slows* it down."

Tom Haines pries open floor tiles to increase airflow from underfloor, Image: Artistic Render by Author

Thermotemporalities, thermomasculinities

I open this chapter with media scholar Nicole Starosielski's (2016) observation that

"media's materiality is composed and recomposed in relation to shifting temperatures" (p. 294).

Following Tom Haines' claim above that "heat is the only thing that slows" time in the data

center, this article asks how "shifting temperatures" may also be crucial to understanding digital

media's *temporality* (Starosielski, 2016: 294). Since the 1990s, anthropologists have argued

against the universality of time (Munn, 1992), documenting the high variability and relativity of temporal experiences across communities (Zeitlyn, 2020). Time, as Tom describes it, is not subject to the waxing or waning of daylight. Rather, the 24/7/365 world of computer servers is sustained through a constant provisioning of cold dynamically apportioned to the heat of "computational traffic" (Velkova, 2016). Designed to operate at low humidity conditions and ambient temperatures between 60 and 80º F, servers require unceasing refrigeration to thrive (Moro, 2019; Pacific Gas and Electric Company (PG&E), 2012; Webb, 2016). Increases in demand for computing resources must be mitigated by a proportional response in volumetric cooling to avert equipment failures. The data center is punctuated by thermal rhythms. The only constancy in this "city that never sleeps" is

one of thermodynamic flux, of hot and cold hermetically partitioned, and of computational heat cyclically abated by refrigerated chill.

In data center industry parlance, *uptime* refers to a state of continuous, uninterrupted functioning of IT equipment, a chill homeostasis that data center operators strive to sustain perpetually. Counterposed to the perpetual cool of *uptime* is the periodic heat of *downtime*, an episode of cataclysmic failure or "heat death" (Moro, 2019) that data center operators work tirelessly to prevent. Like the nineteenth-century paper mills and textile factories reliant on temperature controls to achieve media standardization (Cooper, 1998; Moro, 2019; Starosielski, 2016), data centers demand unrelenting chill to facilitate digital capitalism. Answering Geoffrey Bowker's (2015) call to name the "complex temporalities" that subtend infrastructure, this article introduces the analytic of *thermotemporalities* to describe the conjuncture of time, temperature, and expertise in data centers. In what follows, I draw on ethnographic fieldwork I conducted

among data center operators to illustrate how these *thermotemporalities* emerge in the embodied

practices and discursive pronouncements of research participants, focusing on the binary

opposition of *uptime* and *downtime*. Additionally, I locate examples of similar *thermotemporal*

discourses in prominent industry publications and professional blogs. By the article's end, I

sketch a pervasive, deeply socialized *thermotemporal* complex with a decidedly masculine

character. I employ linguistic anthropological concepts to argue that *uptime* and *downtime* are

not merely referents for discrete events, but are, rather, animating discourses through which

technicians perform an aspirational masculinity (Goodwin, 1994; Silvio, 2010), a second analytic

I call *thermomasculinities*. To further the wider applicability of these analytics, I consider how

thermotemporalities and *thermomasculinities* contribute to and are intensified by larger-scale

formations like anthropogenic climate change and the COVID-19 pandemic.

Cooling servers, warming planet

The same environmental processes by which air conditioning ensures the thermal and operational stability of

computers then create the very externalities that raise the heat of the entire planet, in turn demanding ever more

extreme strategies of thermal control. (Jeffrey Moro, 2019)

Coursing through fiber-optic cables thinner than human hairs, plumbing the abyssal

depths of the world-sea to cross continents, bits circulate at the speed of light, carried by

imperceptible frequencies to their receivers in networked devices. Every search query, status

update, or email proliferates energy that ultimately dissipates as heat. The cloud is hot matter, not

cool ether. Heat pervades the vast assemblage of infrastructures of the Cloud which include

undersea cables (Starosielski, 2015), Internet exchange centers (Burrington, 2015), cell towers

(Holt and Vonderau, 2015), and data centers (Ensmenger, 2018; Hogan, 2018; Johnson, 2019a, 2019b; Velkova, 2016; Vonderau, 2019). Obscured by the sheer complexity of its geographically disparate parts, "cloud" is an opaque metaphor that conceals the ecological footprint of the material processes and exchanges precipitated by tech companies (Amoore, 2018). Perhaps nowhere is this magic trick of muted culpability more evident than in data centers, the vibrant archives filled with servers that emit heat as they metabolize energy and facilitate digital capitalism, governance, and more.

Philosopher John Durham Peters (2015) characterizes the electricity that feeds data center grids as "repressed fire" in that "at one end or another of the gastrointestinal tract . . . there is inevitably smoke and ash" (p. 126). Data centers are overwhelmingly powered by the finite biomatter that political theorist Timothy Mitchell (2009) calls "buried sunshine" (p. 401). In North America, electricity consumed by data centers is drawn from "mixed" energy grids, where renewable energy sources like nuclear, wind, or solar are dwarfed by coal (Özden-Schilling, 2015). While data centers are often touted
by tech companies as "green" infrastructures, their carbon footprint exceeds that of air travel (Holt and Vonderau, 2015: 82) at over 1% of global emissions (IEA, 2022; Hu, 2015: xxv). Given that the typical energy consumed by a single data center is equivalent to that of 80,000 homes, Tom's characterization of his facility as a sleepless "city" is fitting (Burrington, 2015; Ensmenger, 2018: 4; Hu, 2015: 79; PG&E, 2012).

In the opening vignette, Tom insists that heat "slows" down the data center, because heat has the capacity to disrupt server functions. The Internet must be constantly air conditioned to

fulfill tech company promises to customers that data will be accessible anytime, anywhere, that servers will continue churning along at whatever cost. Tech companies encourage users to continuously generate and upload content that they then sell to advertisers for profit, a "surveillance capitalism" that intensifies the ecological toll of the cloud by increasing demands for data storage (Mosco, 2015). Greenpeace estimates that the sum of digital content in 2013 was 5 exabytes (Cook et al., 2017). This same amount of data is now being generated every few days (Cook et al., 2017). With the outbreak of the COVID-19 pandemic, global lockdowns resulted in an unprecedented uptick in digital activity. 2020 was a year that "tested the resilience of the network," one data center executive conveyed to me in a ZOOM interview. As data production continues to trend upward, the demand for more data centers follows, a techno-economic shift that Mél Hogan (2021) calls the "Data Center Industrial Complex." Data centers have become the essential infrastructures of digital capitalism. With their never-ending expansion seemingly naturalized by markets, the ecological impacts of their ceaseless operation are thereby muted.

Denaturalizing digital heat

At the turn of the millennium, natural scientists claimed that a coalescence of ocean acidification, melting ice caps, rising sea levels, and greenhouse gas emissions had inaugurated a new geological epoch called Anthropocene (Crutzen, 2006). In the years since its invocation, a range of alternatives have been formulated to describe with greater specificity and historical accountability, particular ecological crises and their asymmetric impacts on communities (Gonzalez Monserrate, 2022; Haraway, 2016; Mentz, 2019; Moore, 2017; Parikka, 2014; Yusoff, 2018). In the wake of criticism by activists and publics mobilizing against data centers for their

visible ecological impacts (Bosker, 2019; Cook et al., 2017; Vonderau, 2019), tech companies

are rebranding themselves as ecologically conscious actors, taking measures to minimize carbon

emissions, while continuing to construct more data centers and even the energy infrastructures

required to power them (Hogan, 2018). One such "carbon redemptive" measure is the harnessing

of cold climates to facilitate data center cooling via a technique called "free cooling" (Gonzalez

Monserrate, 2022; Johnson, 2019b; Vonderau, 2019). By siting data centers in the Arctic where

temperatures are cool year-round, tech companies have the capacity to cool servers by cycling

ambient air instead of relying on air conditioning. In this instance, nature is "infrastructuralized"

(Carse, 2012; Vonderau, 2019) for the "hardware" of digital capitalism (Hogan, 2018).

The result is an "elemental irony" (Moro, 2019); the data storage industry seeks to

mitigate the warming precipitated by its infrastructures by "housing" data in the planet's last

bastions of cold (Johnson, 2019b). The futility of these arctic overtures notwithstanding

(Gonzalez Monserrate, 2022), a subtext emerges: digital heat and the thermal control measures

wielded to counteract it are posited as *natural* rather than *cultural*. By closely interrogating the

material properties of the elements that subtend digital infrastructures, Nicole Starosielski (2016)

excavates the "cultural logics" that "underwrite" thermal regimes (p. 298). Silicon and copper,

for example, have highly variable properties in nature. Before incorporation into circuits or

microprocessors, these raw elements must first be "purified" through various chemical

transformations that augment their conductivity and molecular stability, enabling them to realize

"a digital order defined by speed and precision" (Starosielski, 2016: 298–299). The most

fundamental elements of computational infrastructures are thus purified to such a degree that

their capacities to generate heat appear *natural* (Starosielski, 2016: 300). If the heat generated by

the materials used to build computing equipment found in data centers is reflective of cultural values, then it stands to reason that the methods by which data centers are cooled, are similarly *cultural* rather than *natural*.

Like the homeostatic chill of *uptime* in data centers, climate activists call for specific industry reforms to reduce the degree of planetary warming, to maintain a cool equilibrium to support capitalist civilization. Failure to stop climate change results in *downtime* on a calamitous scale; a planet rendered uninhabitable (Haraway, 2016); its flourishing decimated in a heat death caused by the whirring machinery of digital capitalism. In this way, Anthropocene might be read as a *thermotemporality*—a complex in which time, temperature and expertise are inexorably hinged. Public discourses about climate change illustrate this *thermotemporal* complex. For example, the precise dates of portended dystopian futures hinge on specific degrees of warming, amid the contestation and politicization of scientific expertise by diverse publics (Haraway, 2016; Yip 2022). While the Anthropocene plays out on a planetary stage, the *thermotemporalities* of the data center occur on a micro-scale, in everyday talk and quotidian practices. In what follows, I illustrate how the cyclical ebbing of server heat calibrates the temporal experiences (*thermotemporalities*) and professional identities of data center operators (*thermomasculinities*).

Downtime: masculinity besieged

The practices of "bumming," pranking, and other forms of technical display that originated in the university computer labs of the 1970s form the basis for a rich culture of masculinity within computing communities . . . the most conspicuous features of this masculinity . . . are not so much a reflection of the essentially gendered nature of the activity but are instead the by-product of attempts . . . to elevate the status of their discipline . . . one might argue

. . . that computer [professionals] . . . rather than being insufficiently masculine, have elevated the performance of masculinity to an extreme. (Nathan Ensmenger, 2015: 65)

Some hours after my tour of gable C3, Tom instructs me on how to properly snake cables through the underfloor plenum to minimize airflow obstruction. I gingerly tug on a coiled hydra of wiring, careful not to over-flex the elastic bands and loosen individual strands. The cold, dry air tickles my arms as I reach into the compartment below the tiles. Tom critiques my form, cautioning that years of poor ergonomics will take its toll on me when I am "a much older *man*." Before I can respond, an alarm starts to shriek. Tom runs off to gable C5, accompanied by a pair of frenzied technicians. I watch as they place standing fans in what seem like random locations and frantically pry open floor tiles to rapidly cool a rack of overheating servers. The air is thick with dread and the men are nearly silent as they rapidly diagnose and act on the problem. Before my eyes, Tom's vision of a segregated world of media heat and mechanical cool disintegrates, and the "chaos" that he warned about when I first arrived takes hold. For Tom and his anthropological observer, time freezes, our breaths quickening, sweat dripping from brows, until, wordlessly, breathlessly, the cold returns and the alarms silence. Color returns to the pale faces of the technicians around me, signaling the return of the cool composure of *uptime*.

Heat death

In the early 2000s, thermal dramas such as the one I recall above were more common than today given technological advances in automation, sensing, and data center engineering (Crosby, 2020; Miller, 2008). In data centers with fewer resources, however, thermal runaway is still a daily concern for operators like Tom. Avoidable thermal outages lead to the "blacklisting"

or "scarlet lettering" of employees, an industry veteran informed me. Even one conspicuous failure can significantly tarnish the reputation of anyone deemed responsible. This is largely due to the high monetary cost of downtime for data center companies, estimated in one industry study to be US$8851 per minute (Ponemon Institute, 2016). An entire genre of industry periodicals dedicated to analyzing spectacular downtime episodes indicate how downtime can also be "damaging" to the image of companies (DCD Team, 2017; Hurley, 2016; Jones, 2011; Miller, 2007, 2008, 2009, 2010, 2011, 2012, 2013). In dozens of interviews I conducted with data center professionals, I observe a pattern of avoidance and deflection when I bring up the topic of *downtime*. As one participant framed it, talking about "it" is "bad luck." The more I probed, the greater resistance I met, as if the mere utterance of the word might manifest its occurrence (McIntosh, 2005). A week after the thermal incident I observed in gable C5, I asked Tom Haines to explain why *downtime* is a taboo subject:

Tom: The data center manager is a fear-based individual. *His* fear is human error, mechanical error, power failure, generator failure . . . *His* whole job is to take every possible action so that failure doesn't occur, so that redundancy kicks in. . . In the industry "downtime" is something of a dirty secret. It's the skeleton in the closet. No one wants to admit that they've had downtime. It's kind of . . .
emasculating . . . but most, if not all, data center managers experience it. It's why they call the industry mission-critical, it's why they recruit ex-Navy *guys*—they've weathered the siege before. They know how to put up a fight [emphases mine].

Driven by "fear," haunted by the specter of thermal "siege," Tom narrates the data center manager as a valiant figure that must "fight" to triumph over the crucible of *downtime*, or fail and be "emasculated." This militaristic theme is echoed by blog contributors in articles titled "Combating Downtime" (Normandeau, 2016) and "Defeating Data Center Downtime"

(Woolverton, 2021). Such discourses signal that Tom is not alone in characterizing the data center as a besieged battlement, where "defense is the best offense" (Spears, 2016). *Downtime*, as Tom invokes it, is more than a state of service interruption or thermal runaway, it is a proving ground through which masculinity is conferred or denied (Butler, 1990). A similar dynamic unfolds in Julian Orr's ethnography of photocopier technicians, who routinely narrate successful repair jobs or installations to their peers as heroic, masculine feats (1996). Tom genders the "data center manager" as a man by default, as if any alternative were unthinkable. Having conceded that "*all* data center managers experience" the "emasculation" of *downtime* though seldom admit it, Tom illustrates how shared experiences of *failure* shape formations of masculinity in data centers (Halberstam, 2011).Unlike the neophytes transformed by esoteric rites into men (Beasley, 2013; Gutmann, 1997), the men of the data center are routinely made and unmade; their becomings and unbecomings bound to the *up* and *down* of thermal tides they strive to control but cyclically fail to tame.

Sketch of Thermodynamic Imaginaries of data center technician, Image: Author

Gender in the data center

In the first two decades of the postwar era, computing institutions were primarily staffed by women (Ensmenger, 1998; Hicks, 2017; Light, 1999). It was only after a strategic program of "professionalization" in the 1960s that computer work became resignified as cerebral and masculine, rather than rote and feminine (Ensmenger, 1998; Haraway, 1990; Hicks, 2017). Historians of computing and information technology document how women were systematically shut out of computing vocations, their contributions to early programming erased, and their

positions reassigned to professional men (Ensmenger, 2012; Hicks, 2017; Light, 1999). During this period, a new masculinity emerged, one in which disheveled appearances and diminishing physiques became emblematic of "geeky" manhood (Ensmenger, 2015). In the 1970s, computer operators would routinely tax their bodies to their limits, challenging each other to see how long they could operate computing equipment without sleep or food (Ensmenger, 2015). Institutional professionalization and the concomitant masculinization of IT culture led to a gender flip in the workforce that persists into the twenty-first century (Wynn and Correll, 2018: 157–158). According to the National Center for Women in Information Technology (NCWIT), women hold only 25% of IT jobs in the United States, and represent less than one-quarter of the computing labor force worldwide (NCWIT, 2021; Serenko and Turel, 2021: 43).

In data centers, women's lack of representation may be intensified by the added dynamic of women's marginalization in mechanical and electrical trades (Cooper, 1998; Weston, 1998). As one technician opined to me, "it is rare to see women programmers or software engineers . . . but it is even rarer to meet a woman who can do the tech stuff alongside the mechanical and HVAC—the trades that are traditionally male." Consistent with this technician's observation, a study conducted by the Uptime Institute shows that nearly a quarter of global survey respondents reported that they had no women in their data center operations teams (Uptime Institute, 2021). At Microsoft, 29.1% of workers identify as women, but only 16.6% are in "technical" positions (Robb, 2018). While some have attributed this technical disparity to a lack of STEM training or "interest" on the part of women (Clark, 2012; Curry, 2019; Goetz, 2017; Gonsalves, 2019; Riccio, 2016), others point to structural barriers and a hostile workplace culture for women and

nonbinary aspirants seeking employment (Goetz, 2017; Kenny and Donnelly, 2020;

Serenko and Turel, 2021; Wynn and Correll, 2018).

When I ask research participants why there are so few women in data centers, "choice" is a recurring theme in responses. "Choice" reinforces the futuristic image of IT as a progressive enterprise, while affording some plausible deniability for the scarcity of women employees. Implicit in the notion of "choice" are marked essentialist claims about women's "choices" and what leads to those choices, as a blog contributor below demonstrates:

Men and women are biologically different. People generally recognize that hormones . . .affect a person's behavior, so why is it so far-fetched to believe that women might—as a general rule—be more drawn to one field than another? This is not to say that women are incapable, but they may tend to have strengths or interests in different directions. (Clark, 2012)

The notion that women are "capable" but simultaneously, as an effect of a biological determinant such as "hormones," may be 'drawn' to other fields, naturalizes women's exclusion and "choice" not to pursue IT careers. Marc Jones, a data center executive, asserted to me in an interview that "women are emotional" but their inherent emotionality is not a liability in data centers, because servers and air conditioners are "inanimate" objects. Essentialisms are also marshaled by industry critics, who suggest that "females think differently" and that including more women in leadership positions may lead to greater profitability (Curry, 2019).Given that women used to outnumber men in the information technology sector, many scholars dispute "choice" is an insufficient framework to explain women's contemporary marginalization (Serenko and Turel, 2021; Turkle, 1988). One explanation is what scholars call the "glass slipper" effect, a phenomenon in which "gender-embodied occupational social identities," stabilized through popular discourse, lack of visible role models, workplace

culture, and recruiting practices conspire to dissuade interest (Kenny and Donnelly, 2020: 327).

 While the few women who work in data centers lament their experience of isolation amid ranks of "balding heads" (Riccio, 2016), others describe an openly hostile, "hypercompetitive" work atmosphere, where they must "fight against the sea of men" to be heard, especially regarding technical matters (Curry, 2019). Carrie Goetz (2017), a 30-year IT veteran, writes that a supervisor "kept a calendar on the wall, and any time a woman was in a bad mood, he would mark a red X on that date to predict cycles of . . . behavior." Carrie is not alone in her experience. Between 2010 and 2016, employees at Microsoft filed 238 complaints alleging incidents of gender discrimination or sexual harassment (Dawn-Hiscox, 2018). Perhaps most emblematic of women's marginalization in data center culture is a blog entry titled, "Server Room in the Women's Restroom" (Miller, 2008). The author recounts how a resource-strapped company had to relocate its servers to a handicapped stall in a women's bathroom, to "restrict access" in a cost-effective manner (Miller, 2008). One commenter decodes the article's subtext, chiding that the servers are secure because "there are no women in the data center."

Febrile masculinity

 In a ballroom at a 2018 data center meet-up overlooking the Boston seaport, I watch the January chill seep against a window pane, dappling the city skyline with condensation. Between sips of merlot that stain his brown lips bright purple, data center manager Mike Sloan admits that

"uptime is an unhealthy obsession" that keeps him up at night. I press the issue, asking how he

copes with the stress of facility management.

"It's not something we like to discuss, but I know a lot of guys who suffer from cardiac

issues," Mike continues, draining the remainder of his glass, gesturing for the waiter to

bring another. "Does that include you?" I ask. "Got diagnosed with hypertension . . .

I'm only forty." Mike gestures to his phone, where an application displays a real-time thermal

map of his facility, a mostly blue-green infrared sea. "It's because of this," he

says almost whispering, "the fires I have to put out, the fires I take home with me every

night—*it's* making me sick."

     For weeks after the event, I continued corresponding with Mike via email. In one

email, Mike apologized for his "lack of composure" that night, informing me of his plans

to take a short holiday to "cool-off," suggesting that he was "burnt-out." Given the high

financial and reputational cost of failure both to the company and the individual responsible for

any avoidable *downtime* that occurs in a data center, Mike's "hypertension," reflects a conscious

linking of the "health" of servers and the technicians responsible for their care. "Burnt-out" data

center managers need vacation time to "cool off," or otherwise risk making an error that might

lead to *downtime*. "Cooling off," it seems, is about regaining "composure," a "composure" that

"burn-out" diminishes. As Jeffrey Moro (2022) writes, hot and cold possess "mediatic qualities."

In the world of data centers, the thermal is at once metaphor and material, it exists

simultaneously as a feature of experience and a fixed property, an interface of nature and culture

that is only intelligible through a process Stefan Helmreich calls transduction, the conversion of

signal from one medium to another (2009: 214). In this case, heat is construed not only as a

waste product of computation, but also what Mary Douglas (1966) describes as "matter out of place," a "pollutant" that a cool composure keeps at bay. When Mike claims that the data center is making him "sick," he cannot help but frame this sickness in thermal terms ("burnt out").

Mike indexically links his own health to the operational "health" of his data center, using temperature as a shared diagnostic. European colonists in the alien conditions of the tropics similarly framed heat and humidity as contaminants. Colonial administrators reported a persistent "tropical inertia", a "depleting," "destabilizing" atmosphere that "enfeebled" the intellect, vigor and fecundity of White men "sacrificing" their health to bring civilization to colonies (Anderson, 1997: 1346, 1353, 1366). Bourgeois White masculinity withered in the miasma of "deforming" heat, especially the "mental apparatuses" of White men which were "better matched" to the cool, temperate conditions of the European metropole (Anderson, 1997: 1366). For the colonial administrators, temperature was not only a medium that describes hot or cold, but masculinity and femininity, and civilization and savagery.

In Puerto Rico, a tropical setting that early twentieth century American physician Dr W. W. King described as "nerve shattering" (Anderson, 1997: 1354), data centers managers like Ricardo Ortiz Rosa must contend with a constant of high heat and humidity. I met with Ricardo in the San Juan metropolitan area in September of 2020. Before entering his data center, I was prompted to fill out a medical questionnaire that screened me for symptoms of COVID-19 and any recent potential exposures to the virus. Upon arrival, I sanitized my hands and shoes as instructed before submitting to a digital temperature check at the first security checkpoint. The thermometer beeped once over my forehead, signaling that that my body temperature was not in

the febrile range of +100º F. Ricardo and I proceeded into the facility, his face concealed behind the white duck-bill of an N95 mask and a pair of foggy safety goggles. Ricardo led me past air conditioning units and aisle sensors that informed me that the tropical heat was abated by maintaining a chilly 62º F above most of the server racks. "My great fear is to catch a fever," Ricardo said, adjusting a blanking panel to subtly increase aisle airflow to a rack of blinking servers:

If I get COVID, I have to stay home for weeks, a month, who knows? Then who is going to move the tiles around or change out blanking panels if it gets too hot? Who is going to deal with cooling if the power goes out? How my data center operates reflects on me, I don't trust anyone else with it.

Just like Mike, Ricardo interprets a lapse in his own health as a potential lapse in the health of "his" data center. More than fear of thermal runaway of IT equipment (ambient temperatures of 80º F or higher), Ricardo fears rising temperatures in his own body (a fever of 100º F or higher). Ricardo's company policy stated that any febrile employee would be furloughed until they could prove that they were not infected with COVID-19. Given the higher network demands associated with the Puerto Rican government's "encierro" (lockdown) and mandated curfew in the months following the outbreak of the COVID-19 pandemic, Ricardo's thermal fears are amplifying. With his livelihood and reputation hinged to controlling heat of both a mechanical and epidemiological sort, I was not surprised to learn that his experience of time had shifted. "This year has felt like twelve" he remarked to me, lifting his mask to take a sip of water. The *thermotemporal* intensification Ricardo is experiencing is not unique to Puerto Rico, as the explosive demand in digital services rendered data center personnel as essential workers worldwide (Crosby, 2020).

Uptime: a virile art

The clockwork of male careers has proved easier to join than to change. More women . . . have

careers . . . but careers themselves still fit into the same giant clock. (Hochschild, 2011: 28)

At a convention center in Atlanta in 2018, I set my conference pamphlets down at a high-top table and introduce myself to a pair of data center managers. We speak quietly among ourselves, as the keynote speaker on stage begins his remarks on best practices to maintain uptime in the data center. The speaker, Robert Gray, shifts to the conversational, albeit scripted portion of his talk, inviting the audience to participate. "Can anyone tell me why we call it Uptime? What is the *up* in Uptime anyway?" I take notes as he speaks, observing how the crowd quiets with interest. Marc, one of the attendees at my table shouts, "It's Viagra! Don't listen to him, he's trying to sell you Viagra!" Many in the crowd roar with laughter, a woman across from me visibly scoffs. Robert tells Marc dismissively to "speak for yourself" before proceeding to the next slide in his PowerPoint.

Manly refrigeration

More than a virile pun for the "up" in uptime, the Viagra joke resonated deeply with the men gathered in the salon, as if the link between air conditioning and virility were natural or obvious. Robert Gray, a self-styled guru and "thought leader" on data center airflow management and cooling, did not appear surprised by the content of the outburst, furthering the joke by singling out Marc, with his "speak for yourself" retort. After Robert's talk, I followed up with Marc about his Viagra comment. He told me, it was an "inside joke," one that requires some background on the history of data center cooling to comprehend. With little provocation, he

began chronicling the "olden days" of the data center, when the job of the manager was to "make rooms cool at whatever cost," a method I have since learned is called "flood cooling." In these "wild west" days, as Marc recounts, IT racks were arranged like desks in a classroom all facing the same direction, hot and cold air mixing chaotically in their wake.

In the early 2000s, airflow management and thermodynamic models were widely distrusted, a "dark art" that only the "geekiest" or most well-resourced managers employed, Marc recounts (Miller, 2009). What ensued was an era that Marc described as "whack-a-mole" cooling, where the heroic manager "hunted" pesky hotspots flooding areas with more and more tons of cooling to snuff out thermal anomalies by brute application. Although advances in technology have vastly improved cooling efficiencies, Marc claimed that many of the industry veterans have not yet adapted their mentalities. They prefer to trust their "guts" and "senses" over dizzying screens with reams of provisional data from sensors and models (Figure 4) (Henke, 1999; Paxson, 2012). They prefer to see heat as a besieging enemy and cold as a heroic salve. The "up" in Uptime is thus about the cultivation of manhood and a kind of thermal mastery, the triumph of "man-made weather" over formless heat (Cooper, 1998).

Keeping your cool

In 2015, a prominent industry vendor ran a survey called "Personalities in the Data Center!" on their blog (Castle, 2015). The survey, "based on the psychometric method," measured personality traits of data center managers, displaying the tallied results in an

infographic (Castle, 2015). The survey indicated that 62% of respondents identified as "steady and stable," a finding captioned with "few data center managers are worried about imminent failures, or known vulnerabilities" (Castle, 2015). Represented by an icon of a bulging bicep, the "steady and stable" trait also appears to be communicating an aspirational brand of masculinity, one vastly different from the anxious scenes I sketched with Tom, Mike, and Ricardo. Mirroring the homeostatic chill of whirring air conditioners, data center operators strive to be cool even under duress. In an op-ed, one writer warns against "the Narcissistic feeling of having everything under control" that often leads the "chairman of any data center" on the path to *downtime* (Rojas, 2017). The aspiration is to create a worry-free "chilly climate," to perform thermostatic control and technical mastery, rather than admit fault or incompetence (Wynn and Correll, 2018: 150). Anthropologist Alexander Taylor (2021) observes in European data centers that while "IT failure is an inherent part of everyday working life in the cloud," the emphasis on uptime underwritten in service-level agreements and vendor contracts, creates "intense pressure" for data center professionals to realize an impossible ideal of infallibility.

Data Center Personality Test, Image Reproduced by Author

This behavior, this penchant to emphasize success and to deny or mute failure, is

replicated by data center companies in their promotional materials. On the websites of data center companies, *uptime* is displayed prominently as a percentage (99.x%) to inspire the confidence of potential customers. The (99.x%) percent reflects the portion of the year that servers are operational. Data centers are ranked in ascending tiers based on the levels of infrastructural redundancy in place to prevent or minimize downtime (Taylor, 2021). A Tier 1 data center, for example, hovers around 99.671% uptime (28.8 minutes of downtime) whereas, a Tier 4 data center promises a superior rating of 99.995% (26.3 minutes of downtime), according to the Uptime Institute (2013). Uptime in this capacity, is not merely a temporal referent but an emblem of technical mastery, linguistically skewed to inspire client confidence rather than doubt. Histories of thermodynamics describe the fashioning of energy in terms of work and waste to increase the productivity and profitability of Victorian industry (Daggett, 2019: 111). Data centers are ranked by how often they succeed, rather than how often they fail, or as my research participants suggest, how often the data center is cold instead of hot.

The fear of downtime coupled with the masculine struggle to sustain *uptime* indefinitely through wasteful "flood cooling" techniques, might explain why the data center industry took so long to implement sustainable initiatives, opines Lynn Fischer, one of the few women I was able to interview. For many data center managers in the early 2000s, minimizing the use of air conditioners to conserve energy was met with fear and skepticism, because the threat of a thermal outage was thought to be too great a risk (Miller, 2009). Lynn, an early adopter of airflow management techniques that helped her reduce energy waste in her data center by shutting off redundant air conditioners, describes her efforts to convince "male colleagues" to follow suit as "futile." She claimed that biases against women and their technical capacities

made it impossible for her to be heard above the din of the "cock fight." Shortly after our chat,

Lynn emailed me a scientific study that measures differences in air-conditioning "behaviors"

between men and women in industrial settings. The authors find that "generally . . . males

consume 1.2e1.5 times more cooling energy than females" (Wang et al., 2019), a conclusion that

Lynn claims "backs up" her insights about the intrinsically "wasteful" habits of men who run

data centers.

Thermotemporalities, thermomasculinities

Central to the social and cognitive organization of a profession is its ability to shape events in the domain of its

scrutiny into phenomenal objects around which the discourse of the profession is organized. (Charles Goodwin,

1994: 626)

The late sociolinguist Charles Goodwin argued that the technical jargon he

observed in courtrooms or archeological dig sites was not purely referential or descriptive in

function. Per Goodwin (1994), specialized language is charged with "phenomenal" and

performative capacities that contour "professional vision" and subjectivities. In the data center,

uptime and *downtime* are not discrete referents for success or failure, cold or hot, and masculinity

or femininity. They are, rather, "animating" discourses (Silvio, 2010), thermal–temporal genres

that data center managers harness to perform success or avert cataclysm, to become men or

unbecome them.

First, there is *downtime*, a word so scalding with failure, that its very invocation is feared

or avoided (McIntosh, 2005). Linguistic anthropologists might describe this

quality as perlocutionary force (Duranti, 2004), referring not to the content of the

word but the expected, or in this case, feared, effect of its utterance. In the inverse, *uptime* is a "word that succeeds" (Brown, 1986). Like the companies that prominently display figures of 99.x% uptime on websites and pamphlets, the data center manager repeats the cool mantra of *uptime* to precipitate his success. The data I present in this chapter show that these *thermotemporalities* are not only invoked but embodied, as Mike's "burn out," and Ricardo's dilated experience of time signal.

Philosopher John Durham Peters (2015) writes that "temperature is a medium." Hot and cold are not merely sensations or discrete molecular states, they are vehicles of meaning that stand in binary opposition. Claude Levi-Strauss (1966) deployed this opposition as an analytic to contrast the enervation chaos of civilization (hot societies) with the homeostatic equilibrium of so-called "primitives" (cold societies). In the data center, heat is about the dissolution of form, "chaos" as Tom described it, but also the relinquishing of control. Heat death is a descent into the dark void of nature, which is marked feminine (Merchant, 1980). European colonists similarly reviled tropical heat as chaotic and feminizing (Anderson, 1997). In data centers, heat portends contamination while cold promises purification—the "up" in uptime (Douglas, 1966). Cold connotes form, "composure," and order. While entropic heat periodically triumphs in data centers with *downtime*, populating faraway screens of devices with "server not available" error messages (Conaway, 2016; RM Willet, 2019), the operator ultimately prevails at a rate of 99.x% (Taylor, 2021), wielding elemental and dispositional coolness to quell the siege of media heat with *uptime*. It is in this crucible of cyclical failure and heroic triumph, of manly refrigeration repelling formless, feminine, heat, that

the data center operator is *thermomasculinized*.

       Amid a surge in digital activity precipitated by a global pandemic and a mounting

ecological crisis of planetary warming, data centers churn along, metabolizing carbon

as they cool. To sustain the uptime of capitalist civilization, data center technicians

tirelessly evacuate the heat exhaust of digital capitalism, even as the cooling they

strive to perpetually sustain warms the Earth. The Anthropocene is thus a thermotemporal

scheme, the calamity it portends not entirely unlike the scene of a data center blaring with

thermal alarms as downtime strikes. In this article, I have marshaled ethnographic data to

illustrate how a performative species of masculinities emerges in the *thermotemporal* interstices

of cool *uptime* and hot *downtime*. The *thermomasculine* episodes I recount empirically

substantiate Nicole Starosielski's (2016, 2021) theorization of the thermal as cultural.

Precipitation: Heat Deaths

Temperatures in excess of 98.9°F/37.2°C indicate febrility in a human body. Temperatures in excess of 81°F/27°C indicate overheating in server. Global temperature increases in excess of 1.5°F/2.7°C by the end of the century will result in cataclysmic ecological collapse following the extinction of coral reefs. Temperatures in excess of 108°F/42.2°C will result in heat death (cardiac arrest). Temperatures in excess of 150°F/70°C will trigger a heat death (server melting, automatic shutdown sequence). Global temperature increases in excess of 4.5°C by the end of the century will result in heat death (extinction of *homo sapiens sapiens*). Coronavirus warms human bodies, pushing them online to prevent species thermal runaway, leading to server heat that warms the planet (Heat Death[3]). I think I have contracted ZOOM fever.

II - Cloud Clamor

Cumulosonus

This story begins in Chandler, Arizona on the ancestral lands of the Huhugam people and their descendants in the Gila River basin. In what follows, I inhabit the settler subjectivities of my research participants to retell their encounters with the Cloud's clamor. While the events I depict here are largely faithful to my archive of audio recordings, transcripts, text messages, emails, and field notes, I have combined, omitted, or fabulated selections of conversations or events, for the sake of narrative coherence, an approach inspired by sociologist and speculative fiction writer Malka Older called "evidenced-based creativity" (2020). I use pseudonyms and composite characters to protect the identities of my research participants. This is their story.
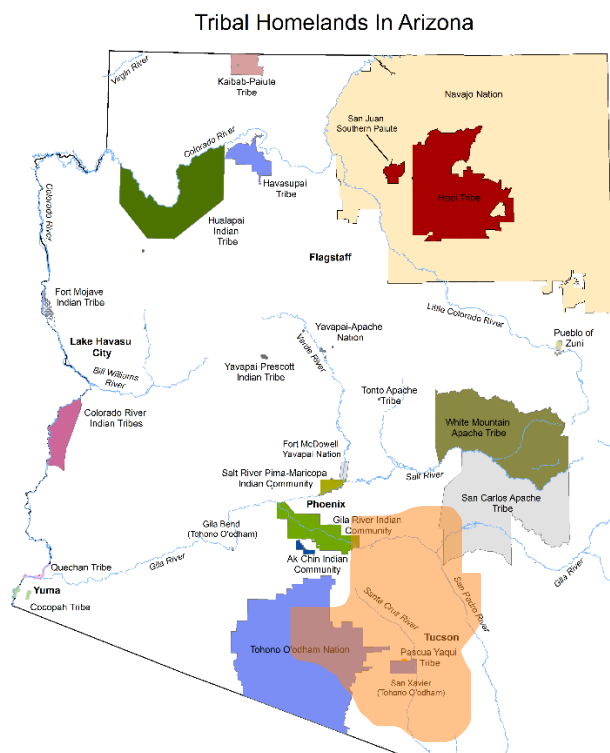
Image: "Tribal Homelands in Arizona", via Inter Tribal Council of Arizona

Chandra: October 2018

On one of his midday strolls through Brittany Heights, Chandra noticed the disturbance

for the first time. It began as a generalized sense of unease. A splinter wedged in his thoughts. At

first, he wondered if his overworked mind was playing tricks on him. Or if this anticipatory spell

of dread was related to the migraines that he had been experiencing more frequently in recent

months. Irritated, Chandra retired early that evening, hoping that extra sleep might ward off

whatever was ailing him. But as he rested his head on the pillow and shut his eyes to drift off to

sleep he found that he could not – for the stillness of the night only magnified *its* presence.

Brittany Heights via Google Maps, Screenshot by Author

Brenda: October 2019

It was late in the evening when Brenda first sensed that something was wrong with her world. For weeks she ignored a strange, nameless presence that stalked her to and from the local grocery store or as she sunbathed by the pool. Her senses felt scrambled, overwhelmed by a gnawing constancy that no one else in her household could detect. She suspected her grueling 12-hour nursing shift rotations in the hospital were to blame, or maybe, some affliction was taking hold of her, the culmination of a decade of workaholism and self-neglect.

Martha: September 2018

Martha strolled around the neighborhood in the cool of predawn, listening for the songs of brown-breasted flycatchers, finding something else muddying the tranquil autumn milieux. The something was there when she returned from work, when she watered the plants in her garden, and when she strolled to the local Mexican spot to get tacos with her pet bird on her shoulder. She wondered if anyone else was aware of it, or if they were all choosing to ignore it, or… if they had formed a vast conspiracy against her, pretending that nothing at all was astir, when in fact they all knew that it was there all along. What was it and what did *it* want?

James: March 2020

The haunting began on a spring morning, boring through the window to his penthouse apartment in cloudy Chicago. Twelve months of lockdown, twelve months of terror. His unwelcome guest was there to keep him company, to confuse and annoy, driving him to the brink of teeth-grating madness. He took to his computer to solve the mystery, searching for answers and other victims of this nebulous crime.

Cyrus One Data Center in Chandler Arizona, Photo by Author

Steve: January 2021

Above the shrieks of children in the playgrounds and the whooshing of cars careening up and down Dobson boulevard, it is there. In the evenings when the scorching sun retreats and gives way to a tolerable cool, when residents gather to enjoy the footpaths and picnic tables and basketball courts of Chuparosa park, it follows them, riffling through the burnished green boughs of the palo verdes at its edge. Like a phantom it stalks the residents of the Arizona suburb of Chandler it calls home, seeping through cracks in the windows and plaster walls of their homes, whispering to them as they sleep.

Just beyond the perimeter of the park and the gated communities is the source of this invisible menace, a nondescript industrial building, fortified with concrete walls and no trespassing signs. Within it churns one of many engines what we call the Cloud, droning with the flotsam and jetsam of digital capitalism; status updates, video streams, messages, emails, and more.

Cyrus One Data Center in Chandler Arizona, Photo by Author

The mechanical din is there when I arrive, a faint, yet, palpable resonance that greets me as I open the door to my car and walk out along one of the many concrete footpaths that cut across the park. It is there, too, when I return over the course of six months to meet with residents, one at a time, to hear their stories. With the hum emanating around us, they recount tales of discovery, the day or evening they first "heard" the acoustic waste of the digital, and the loneliness and anxiety that followed.

Chandra: December 2018

For weeks, Chandra's wife bickered with him over his new 'obsession' with the hum he claimed was ever-present and intolerable – a hum she claimed not to be able to hear. Chandra's walks grew more erratic and frequent, his routes increasingly circuitous even as he used his smart-phone to record the strange pulse from multiple points in the neighborhood (an effort to triangulate the source of the cacophonic signal). On his lunch breaks at work, he would input

data into a spreadsheet, seeking to map the disturbance as might a citizen scientist.

One evening just before midnight, after several "hunts" using his car to cover more ground, he returned to find his wife awake and irate. Alarmed by his absence, she accused him of having an affair, but before she could finish slinging further insult, he proclaimed with glee that he had at last identified the source of the "acoustic attack". She nodded in understanding, resigning to listen to him with more seriousness than before. A week later, Chandra's wife and two daughters claimed they could finally hear the shrill droning that haunted him. Chandra was no longer alone. Now there were three.

Brenda: January 2020

"Cat-scan came back clean, Bren," Elliot, her attending physician said to her at the clinic.

"Really?" Brenda asked, more troubled by the good news than relieved.

"As far as I can tell, there's no evidence of anything exotic going on – no tumor or anything like that."

Brenda sighed, "maybe I should see a therapist."

"It's probably just stress," Elliot said, and then bent forward, whispering, "you know menopause can do a number on your mind and body. I think you just need a long holiday."

"You're probably right," Brenda said with resignation.

Filled with doubt, she went to therapy and to a psychiatrist who prescribed her some migraine medication. No amount of pills, however, could hide what she had conclusively determined was a kind of pulse not unlike the bass boom of teenagers partying in a house where the parents were away on vacation or an extended business trip. Some nights it sounded more

like thunder, or an airplane revving up for takeoff but never leaving the runway.

Being a PTA mom had its advantages, and now she had something to complain about to the Mom-squad besides critical race theory and mandatory masking. So Brenda called up everyone she knew, said her piece, until one of the Moms referred her to an old Facebook page for the Dobson Noise Coalition, a band of disgruntled residents haunted by the noise pollution of none other than a data center – whatever that was.

Martha: January 2019

Winter in Arizona was the best time to be outside, to enjoy the patio and the parks and lush arboretums before the punishing swelter of Sonoran Desert heat arrived in the summer months. Martha loved nature. She spent much of her time with animals, with her parrot, Archimedes, on her shoulder, as she basked in the tranquil wilderness. Having spent so much time outdoors, Martha realized quickly that the source of the noise was coming from a newly constructed building at the edge of Chuparosa park. An aesthetically bereft, unremarkable concrete facility secured with chain-link fences and ominous warnings about trespassing. As a professional architect, Martha was especially equipped to make sense of the story behind the data center's construction, a confluence of zoning laws, tax incentives, and poorly thought-out designs that resulted in their current predicament: noise pollution.

City of Chandler, City Code: 2018

11-10 Public Safety

Prohibits all noises that are disturbing or unreasonably loud. The types of noises set out in

subsection B. shall not be deemed or construed as in any way exclusive, but merely illustrative.

Post by ██, *Dobson Noise Coalition Facebook Group, 2021*

James: February 2021

      The tremors started a few months into the pandemic. A young man, James was startled by

the rapid decline of his health. He felt frail and weak. He suffered from sleep deficit, severe

anxiety and sporadic panic attacks. The Chicago data center's hum was killing him and he was

desperate to know if he was alone. In what struck him as ironic, he used the very infrastructure

that tormented him to find others that might understand his plight. Soon he was commenting on

the Dobson Noise Coalition Facebook page, a community in Arizona suffering as much as he

was. He communicated his plight to residents, sending a private message to an Anthropologist from MIT who had recently joined. With those credentials, he wondered if this social scientist could make a credible case on his behalf, or at a minimum back him up when he took the fight to Digital Realty, the offending data center company. Unless, of course, this Anthropologist was working for *them*. Perhaps he was compromised, bought off like the City Officials who were ignoring him. Perhaps he was a plant, sent to debunk their claims. It didn't matter. He seemed interested in talking and James wanted to talk to someone, anyone. Talking made it marginally better. It was better than remaining quiet.

Post by ▮▮▮▮, Dobson Noise Coalition Facebook Group, 2021

Holy Shit someone has their Boeing 747 parked in the neighborhood and has left it running! Oh wait Cyrus One..

Steve: July 2021

Over the course of six months, I met with Brenda, Martha, and Chandra frequently in Chuparosa Park and at the local Mexican restaurant downtown to discuss their experiences living with digital noise pollution. I also occasionally met others who reported similar stories, but the four of us had become something of a cohort, and I quickly realized that the Dobson Noise Coalition that I sought to study had been all but disbanded when the pandemic struck. Within a few months, people started writing to me and Brenda and Martha and Chandra, asking when the

coalition was meeting next, as if *we* were its leaders. And then I realized that we had become the coalition by default, or its latest incarnation. I did my best to take a backseat as the resurrected group organized a community meeting with residents, lawmakers (state and federal), city officials, and industry representatives from the noise-polluting data center, Cyrus One.

Post by ▮▮▮*, Dobson Noise Coalition Facebook Group: 2021*

Do you hear that??
The hummmmm is louder than the whine
tonight?

Steve, Field Note Entry, "The Lorax": March 2021

It is a sleepy, cloudy morning when I get to the diner to meet with Martha Hartman, a resident of the nearby Germann housing community of nearly two decades. Her soft, blue eyes perk up when she notices me. On her left shoulder, Archimedes stirs, emerald feathers puffing up around a rosy face terminating in a golden beak. I pull up a chair to take my seat, the metal scraping against the concrete in a revolting screech. I open my mouth to greet Martha, but I am interrupted by what sounds like an echo of the painful shriek. From the corner of my eye, I notice Archimedes swiveling his tiny head, claws shuffling on his human perch.

"He hasn't eaten today," Martha sighs, her ruddy cheeks flush, "that's why he's acting up."

"It's alright," I say softly, bracing my ears for another sky-piercing shriek.

"I know, it's pretty shrill," Martha chuckled, golden-brown curls bouncing, "but anything is better than *that*."

With her slender arms she gestures to the ominous, spartan buildings looming behind Dobson boulevard and Chuparosa park, where teenagers were running lay-ups on the basketball court. I nod grimly, because I can hear it above the steely clatter of forks on plates seeking the syrup-soaked flesh of pancakes, over the whirring of cars and the dribbling of the basketball.

"It's so sad, Steve," Martha starts, "think of the animals. How it affects the migration patterns of birds. How it confuses deer and everything else. I hear in Canada they don't put these near wildlife."

"Maybe the zoning laws are different there," I say, understanding immediately why the other members of the Noise Coalition have given her the nickname, the Lorax.

"We humans can handle it, it's annoying, but we can deal," Martha says, wiping the lenses of her crimson glasses. "But animals, they didn't evolve to live like this."

"So from your perspective as an architect," I asked, "I'm curious where you think they went wrong? Where should they have built it?"

Martha narrows her gaze, Archimedes swiveling his head as if they are both equally in the depths of quiet contemplation. With a tilt of her head, she draws my attention to the pink jags

of the mountains jutting up in the miles beyond Chandler.

"Out there, in the open desert," Martha says, "nobody's out there. Not many animals either."

"Hmm," I mutter, "I thought the land west of the 10 was Gila Indian reservation."

"It is I think," Martha agrees, "but as I said, **nobody's really out there**. It's all just **empty land**. *They* don't use much of the space."

Just then the waiter comes to take our order, and he reaches to pat the tuft of feathers just above Archimedes gleaming beak. Archimedes accepts the affection. Apparently, he is a regular at this establishment.

A week later I return to the park, to peer out at Martha's "empty" wilderness. I study the rosy silhouettes of the Estrella mountains, desiccated spines softened only by puffs of wispy mesquite and creosote that take root in the parched rock. Then I look to the park, marveling at the lawns and the palo verdes that are only possible as result of irrigation. They have terraformed this place to fit their vision of the American dream. Out *there*, in the "unsettled" wilds of the Sonoran Desert, is where the mechanical noise belongs, Martha and others tell me, not *here* in Chuparosa Park, the cynosure of a middle-class white suburbia, a sanctuary built to remedy the "clamor" of the Phoenix metropolis*. I take quiet stock of these notions of "here" and "there", of "civilized" and "unsettled", "rural" and "urban", and think about how the great desert beyond, a vast parcel of land stewarded by the Gila River Indian community, has come to be thought of as a more appropriate receptacle for the acoustic waste of the digital. It is then that I realize, that the "acoustic attacks" experienced by Chandler residents, might echo the terror of early settlers and

copper miners who arrived in the Valley of the Sun as the indigenous communities they displaced retaliated. The noise pollution reminds them that what they have built is a façade, that their oasis is just short of being swallowed up by the 'wild' desert they stole, that the capitalism they worship will betray them, bringing the "clamor" of poor urban life to their middle-class, white paradise.

** From the City of Chandler website, on the community's history, "the citizens of Chandler enjoy a quality of life unsurpassed in the Valley today. It certainly appears that Dr. Chandler [town founder and rancher] knew what he was doing the day he dreamed of this **jewel in the desert**."

Post by ▮▮▮*, Dobson Noise Coalition Facebook Group: 2021*
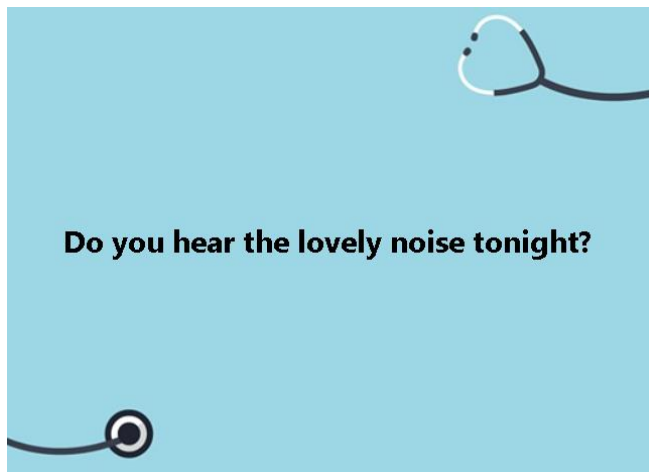
Dobson Noise Coalition: May 2021

Dear [Insert Name of City Official/State Rep/US Senator /Data Center Operator],

We are a coalition of Arizonan constituents who reside in Chandler and we are reaching out to request your assistance with the matter of the noise pollution emitted by data center facilities in our communities. For years, data center noise has afflicted our communities, with adverse effects on our mental and physical well-being. Given the impact of this issue on your constituents, we request your attendance at a community meeting on Wednesday, June 16th at 7pm at REDACTED in Chandler.

The purpose of our meeting is to foster dialogue between residents and other members of our community affected by the persistent noise coming from data centers located in close proximity to our homes for the past five years. Our goal is to once more highlight the extreme inconvenience and health issues created by the incessant noise, and to ask for the industry and city representatives to work expeditiously towards a solution that would reduce the noise to levels not harmful to the residents. We have invited residents from Germann, Brittany Heights, Clemente Ranch, Stonefield, San Palacio, and other residential communities in the City of Chandler affected by the incessant noise created by data centers. We would greatly appreciate your participation in this event, as your input may influence how we choose to proceed.

Thank You,
Dobson Noise Coalition

Post by Chandler Police, Twitter: 2018
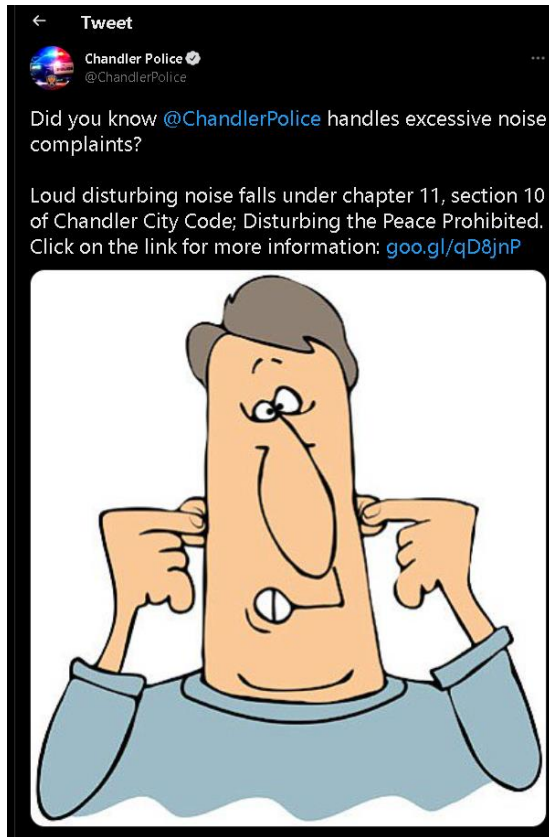
Bob, Data Center Manager: May 2021

I never thought these disgruntled PTA moms would get so much national attention. Why so much outrage for a little hum? The noise is much better after we put some attenuation blankets on the chillers, which wiped out my entire expansion budget. We did everything right. We got the permits, did a sound study. The police can't stop us and they stopped bothering after that lunatic Chandra called them for the seventh time in two weeks. What more will it take to silence these people? First they bring a reporter from the Atlantic and now there's this Anthropologist mucking around, talking, instigating. I told the boss not to respond to the

invitation. It's going to be a sham. They're going to whine about their quiet perfect paradise being ruined by a little noise.

Spend the day inside my facility, then come talk to me about noise. Walk in my shoes with the stress of running a place like this and then come tell me that what I am doing is evil or that I'm not doing enough. But I have to go to this meeting. Boss says the hysterics managed to convince someone from the US Senate's office to attend the meeting. The Mayor has our backs and so does the City Manager, but things could get ugly if they have reporters in there. I've heard this MIT Anthropologist might be working with the coalition, maybe we can discredit him. I gotta go put on my charm and see how I can turn this around. Throw them a few crumbs to shut them up.

Post By Chandra, Dobson Noise Coalition Facebook Group: Spring 2020

3/2/2020 Midnight. Cyrus one noise too loud to bear. Headache.

3/1/2020 12:47am. Cyrus one chiller noise loud, clear, and very disturbing.

Post attenuation: The Cyrus One chiller whine was loud and clear - just like before attenuation. The noise is now entering my master bed room and I am unable to fall asleep. What are our options? now that Cyrus One states they have attenuated all 56 chillers?

Steve's Email Inbox: Late May 2021

Dear Steven,

I just wanted to thank you for taking the time to ZOOM with me. It felt really good to get that off my chest and I really appreciated all of the advice you had on how to strategize and prepare for the HOA meeting. I hope you can send those articles on the health effects of noise on the body, that would be useful. It would also mean a lot to me if you could attend (June 4th @ 3pm). The meeting is virtual. I don't expect you to say anything but I think seeing your face and knowing you are there will keep me grounded because as I was saying I haven't been able to focus or speak clearly lately because I swear the sound is getting louder even though everyone else says it is the same but really it is getting hard to even type things like emails. Also, you know, sorry if this comes across as harsh but if you could send that letter from your university validating your credential there that would help relieve some of my anxiety because I am really starting to get paranoid. I know Digital Realty has a lot of power and influence and I don't want to get duped.

Thanks!

Yours from Chicago,

James Gray

Steve: May 2021

I went to Brenda's house today to drop off some more flyers to promote the meeting. Her place is a poster child of the American dream. It was an almost eerie pulling into the gated community, passing by the manicured lawns and blooming gardens and swing-sets and cul-de-sacs to park my car and hear it, rumbling through the windows, over my engine and air conditioner. I stepped out, assailed by the staggering heat, the chirping of birds, and that wicked data center drone. Inside, Brenda was waiting for me unmasked with a fresh pitcher of lemonade. Her dog greeted with me with a few nervous barks before returning to his pile of pillows in the living room.

"Another 30 or so in this stack," I said, handing them to Brenda.

"Thank you," She replied wearily, "you're a godsend."

"No problem, I had to pass by Staples on my way down from Mesa," I said, examining the flyer, which attempted to inspire residents with the phrase, "Our turn to make some noise!"

"I heard back from Senator Kelly," Brenda smirked, "can you believe they are sending someone to the meeting?"

"That's impressive!" I said, sipping the sweet, cool lemonade, "it will be hard for the data center to ignore you if you're getting federal officials involved."

Brenda nodded, and there was a moment of silence. Above the quiet we both could still hear it.

"Chandra is skeptical," Brenda sighed, "but then again, he was there in the beginning, a man on a crusade. The city made promises before that they didn't keep. And now there are more data centers in Chandler."

"I imagine this kind of fight can wear a person out," I said, thinking of Chandra's sigh-laden retellings of his stand-offs with city officials and police officers. "Between being a Mom and working those graveyard shifts at the hospital, I am really amazed that you find time for this."

"It's my neighborhood," Brenda replied, "it was *ours* before it was *theirs*."

Brenda caught my eyes scanning the framed photographs of her children, who bore a striking resemblance to their mother, golden-haired and bright-eyed. "My kids grew up playing in that park, when there was *peace and quiet.* We moved here to get away from *the riff-raff of the city*. And then one day the construction started and we had no idea what we had signed up for. I feel for these people who invested their life-savings into these homes that were supposed to be

sanctuaries. Now we are trapped. And I'm not gonna just lie down and take it."

"That reminds me of what Martha said," I began, "about it being easier to bury your head in the sand than to fight back."

"Yeah, and I guess with the pandemic and everything, that's what we all did," Brenda said, shifting her gaze to me, "until you came along and stirred up the pot."

I chuckled, "I just came to listen."

"And instigate," Brenda said waiving her finger in the air. We laughed together and she offered me a beer. "I haven't felt so much hope in a long time. Maybe we'll really get our neighborhood back this time."

Post by ▮▮▮▮*, Dobson Noise Coalition Facebook Group: 2019*

HUMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM
M😡😡😡

[Excerpt] City of Chandler Council Meeting: February 2019

MR. HORN [Permitting Office] said that [CYRUS ONE currently] has two buildings under construction that are called Buildings 9 and 10.

COUNCILMEMBER LOPEZ wanted to clarify that in the permitting process there were no sound requirements or sound attenuation requirements in the permits or development agreement.

MR. HORN said he would have to review the development agreement but for permits there are no requirements.

COUNCILMEMBER LOPEZ inquired about the City noise ordinance and if this noise is mentioned since it is a *tonal sound*.

KELLY SCHWAB, City Attorney, stated that the noise ordinance does not have that specificity but does prohibit all noises that are disturbing or unreasonably loud and it does have an exception for normal noise of a business during business hours.

MR. DIEPENBROCK [DOBSON NOISE COALITION] stated they hear this noise also outside of business hours.

COUNCILMEMBER LOPEZ stated he is familiar with data centers and that they run 24 hours. Councilmember Lopez wanted to clarify that there was some generator testing that produced noise which would be additional to the noise they normally hear.

MR. DIEPENBROCK stated they did do a construction project…to upgrade their cables and electrical from the substation and had some loud generators running. The neighbors knew that and were waiting for the project to be over and understood that it was a temporary project. That is not the noise that they are concerned with. **The neighbors are proud residents many of which bought their homes when they were still farmland.**

COUNCILMEMBER LOPEZ stated that he understands that **the noise is beyond expectation of what they would think would be built next to them.** Councilmember Lopez said the Council takes these concerns to heart and will look into what avenues are available to them before they can make any promises of action.

MR. DIEPENBROCK said that is all they are asking. Mr. Diepenbrock said that because there are no noise requirements in the permitting process they have likely used sound blankets which does not require a modification to structure and thus does not require a permit.

COUNCILMEMBER HUANG thanked the residents for their presentation and for their courage to speak up to make the City a better place.

MAYOR HARTKE said he was able to visit with some of the neighbors and **heard the tone they are talking about.** Mayor Hartke thanked the neighbors for taking the time to speak with him and their perspective is consistent with the presentation. Mayor Hartke stated he would like staff to see what has been done and asked the City Manager if they can proceed with that course of action.

MS. REED said they will look into it immediately.

MAYOR HARTKE said he would like to write a letter as well on behalf of Council if staff believes that will help. Mayor Hartke said **he would like to compel them to be good neighbors**

rather than other actions that might have unanticipated consequences on other businesses.

Mayor Hartke thanked the neighbors for coming out.

COUNCILMEMBER ORLANDO said he would like staff to look at the noise ordinances and how they compare to other communities to see if it may need to updated to include **new technology**.

VICE MAYOR ROE said he appreciated the neighbors coming to present and that the Council does not take the situation lightly.

Steve's Email Inbox: June 7th 2021

Hey Steve,

Thanks a million for showing up and for the video chat afterwards. It was great to have you there and thanks for talking about the data center, I think it helped. So the HOA appealed for a public hearing with the Department of Health sometime next month. Date will be announced in a few weeks or maybe tomorrow I should really check back. Also, sorry if it was awkward but I appreciated you walking me back from the edge of the cliff so to speak. These panic attacks are happening more frequently but I'll try those breathing exercised you recommended and yes, I will try another therapist maybe I can bill digital realty for them. Sometimes I just want to walk away from this condo nightmare but you know I'm starting to think I have a chance. A few of the other residents are going to meet with me in a few days. I think they can hear it now. Feels good not be the only one anymore. Anyway, I'll keep in touch. But a reporter came by and looks like we'll be on primetime, maybe that will be what tips the scales. I hope so. Getting tired. Should really sleep. Got the earplugs that Chandra recommended and they are helping me get through longer stretches without waking so thank him for me when you see him.

Thanks again for everything.

James Gray

Steven: Early June 2021

Met with the coalition today at the Mexican restaurant. We ran through our scripts and agenda items and had the opportunity to scope out the area where we will be gathering. The management was very accommodating with our request. It was just after we finished business that Martha proposed a toast and a selfie.

2021 Dobson Noise Coalition, Photo by Author

"I just want to raise a glass to Steve and all his hard work bringing us together."

I squirmed at the recognition but smiled nonetheless. I never intended to be involved. I came to Chandler to listen, as I told Brenda, not to intervene. But listening is never innocent it seems. Hearing is not passive, nor is it apolitical. And on some fundamental level, my willingness to hear their harms imbricated me into the social and political fabric of their community. By listening to *them* I had chosen a side. In all fairness, however, my attempts to hear the other side's story had been met with silence. CyrusOne never gave me a chance to hear their perspective on the matter. And so I could only extrapolate about the inner workings of their facility based on proxy experiences, other data centers I had toured in the Valley of the Sun, which had managed not to be notorious for noise pollution. Having seen these other facilities, and the extensive sound attenuation measures they adopted, elements of design and implementation considered in the early stages of construction and certification, I realized quickly that CyrusOne's racket was not technological, it was political. They chose to be loud because being loud meant more profit, less cost on overhead. They chose to be loud because they had the power to be loud. The noise made by the coalition could be drowned out. The city ordinances and police department were on their side. The city's vested financial interest in keeping them there, and the lack of legal precedent for the harms they were inflicting on residents, shielded them from any real consequences. It was in that moment, that I accepted my decision to join them, my decision to take a side, because this story was never about noise, it was always about power. The power to be heard, to power to be loud.

But power was not the only aspect of this story being muted by the data centers' din. This was also always a story about race. And shortly after our glasses clinked and our plates of food

arrived did that come together for me in a big way.

"You'll have to tell us what you think of the green chili sauce," Martha said, "I mean, as a native, I want to hear how it stacks up to your Mom's cooking."

I could see Chandra's eyes dart over to mine, perhaps he was remembering a previous conversation we had about being a hyphenated American (Puerto Rican versus Puerto Rican-American | Indian versus Indian-American). Or perhaps he caught Martha's misrecognition of my ethnic origin.

"Well in Puerto Rico our food is less spicy-hot and more salty and fried," I replied gently, "but this tastes great, and as someone who grew up on the East Coast I feel blessed to be able to eat this – we don't get good food like that."

"Oh," Martha said, mulling it over, "I didn't mean to-"

"Don't worry we'll make a proper Arizonan out of you soon," Brenda said with a smirk, passing me a bottle of scary-looking ghost pepper hot sauce.

We decided to have another round of margaritas as we parodied what CyrusOne might say at the meeting. It was at that point that the conversation shifted to politics and a collective distrust and disgust for politicians of all stripes. It was then that they all confessed their party

affiliation as Republicans, with Chandra identifying as a registered R-leaning Independent and #Never-Trumper.

"I mean, it's like we have forgotten how to have a conversation, how to really listen to each other," Brenda started, "and it **doesn't matter what your color** is **we're all human** and you know I work with a lot of Indian people and we all just want the same things. Why is everyone so obsessed with what makes us different?"

Chandra nodded, "I think you're right, I mean we're just trying to raise our families in peace. And we all strive for that. Which is why the coalition brings together everyone because we can all agree on that."

Martha butted in, spilling some Margarita as she leaned in, "it's like everyone wants to whine today. So much complaining and whining. Sometimes you have to strap in and work hard and pay your dues like everyone else. This is the generation of short-cuts."

Brenda leaned in, "Steve is the only liberal here, so sorry if this offends you, but you know, I don't agree with critical race theory. I don't think it should be taught in our schools. Because what's the good in that? We need to raise our kids to take action not teach them how to find excuses for why their lives aren't the way they want them to be. It's like what I was saying before about obsessing over difference when we have so much more in common."

I sipped my margarita, careful not to get too inebriated, "I know you're on the PTA and is that a big issue for the community? Do you think race is something important for people here in Chandler?"

Chandra chimed in, "we all care about it. The people here are generally good with it. Our police chief is African-American you know?"

"It's a good community," Brenda said, "and as long as you are a good neighbor everyone accepts you. Take a stroll through the park and you'll see what I mean."

As they dismiss racism and its prevalence in US society, I recall many walks through Chuparosa Park, where I seldom encountered anyone who wasn't phenotypically legible to me as white. They wanted race to be invisible, irrelevant. This quest, I realized, to end the noise, was not only to reclaim a quiet lost to digital industry, but to recuperate a white suburbia that purported to be colorblind.

Steve's voice recorder: June 16th 2021

Brief reflection and recap of the big meeting while it's fresh in my head. [car rumbles as I get to the on-ramp of the highway] Where do I begin?

We showed up early, dressed to the nines. Formal garb indexes authority. Management decided to move us inside to keep us cool (it was 115 F today) – so much for COVID protocols. The Mayor and City Manager were the first arrivals. Sadly, only four other residents showed up. The State Rep and the person from the US Senate's office arrived shortly after the Chandler City officials. What shocked us the most was to see *them* there. They never bothered to reply to our emails, but apparently after getting whiff of who might be in the crowd, CyrusOne decided to send two of its employees to represent its own interests in this "friendly" dialogue. The first, Gary, an Executive type, based mostly out of Texas. The second, Bob, the site director of operations, who resides in Chandler and introduced himself as a neighbor.

The four of us cloistered together at the helm of the family table, seated directly across from the mayor. We decided to delay the proceedings for five minutes to allow more residents to

trickle in. In the interim, we introduced ourselves informally. When the CyrusOne folks arrived, I made a point of introducing myself, and was greeted with hostility.

"I'm Steve Gonzalez," I said, shaking Gary the Executive's hand firmly, holding his gaze without flinching.

"He's the one from MIT," The Mayor chimed in, beaming.

"Nice to meet you Mr. Gonzalez," Gary started, "we've heard so much about you."

"Oh really?" I smiled through clenched teeth, recalling the scores of emails, LinkedIn messages, and phone calls, that went unanswered by CyrusOne.

"So Mr. *González* (exaggerated emphasis)," Gary said, gesturing to his menu, "I'm gonna lean on your cultural expertise to make an informed decision about the menu, I don't come to Chandler much."

"Oh right, so you're Mexican?" Bob said with a sigh, "yeah I've heard MIT mostly recruits immigrants. Guess that's where all the talent is these days."

I open my mouth to speak, "I'm actually not an immigrant and I'm also not Mexican, I'm Puerto Rican."

"Puerto Rico?" Gary said, "my daughters want to go on vacation there next month. Any recommendations?"

It took a lot of restraint and Anthropological zen to withhold my tongue but I did and I am glad of it. But I think that sour start set the coals ablaze. Thankfully the meeting started before I could offer my recommendations on where to go in the Borikén of my ancestors (see previous chapter for more on that), or for Gary, the colonial playground and vacation spot of Puerto Rico.

The meeting went largely as planned. We began with formal introductions before transitioning to the business. Chandra started us off, drawing a timeline and narrating the course of events that preceded the meeting, the first onset of the noise in 2018 and the broken promises by city officials leading up to the present. He closed by stating that "there will be many more Chandlers in the future, if nothing is done at the policy level to stop this from happening at the local, state, and federal level."

Martha offered some recommendations for how the problem could be sorted from the perspective of an architect. She also smuggled in a few personal anecdotes about her experience with the noise and her concern for how it was affecting local wildlife.

Brenda went next, striking a conciliatory tone to transition to the "forum" part of the evening. "Look, we just want peace and quiet again. We're all neighbors here. In the end we're not going anywhere and we accept that the data center isn't either. I know we can find a way to co-exist better and have open and honest communication as a community."

The Mayor and City Manager we're up next. They apologized to the community and pledged to be better communicators and take the issue more seriously. In a move contrary to what was planned, they ceded the floor quickly to CyrusOne, who they said were better positioned to talk about what was being done or what wasn't.

CyrusOne began by inventorying all of the sound attenuation they had conducted on their facilities to date, emphasizing the enormous financial cost of such attenuation efforts. They conceded that they needed to be better communicators and pledged to add the Dobson Noise Coalition to their system as a "new customer", so that they could be updated on scheduled generator operation or site expansions that might cause noise via email.

Then in a move that felt to me as staged, the local employee, Bob, stood up from his end

of the table to discuss a personal matter. "While we at CyrusOne regret how our data center is affecting this community, I need to state firmly and clearly that our employees should not be personally targeted for where they choose to make a living."

I watched Martha gasp, as he began to recount episodes of harassment at the local grocery store and on social media by aggrieved residents. "We're human beings," Bob insisted, choking back what sounded and looked like false tears, "just remember that."

I caught Chandra's eyes-rolling and heard Brenda say, "that is unacceptable what is happening to you. Harassment won't get us anywhere."

Once the floor had been ceded, the Representative from US Senator Kelly's office said she had mostly come to listen, but that she was especially curious about what I had to say, as an external "expert". The Mayor chimed in as well, saying, "Let's hear what Steve has to say."

I knew it might be coming. I had prepared a few mental scripts in the instance that that might occur but I didn't have anything solid. I didn't want to be too rigid. I was afraid that being too committed to any one stance might put me in a bind. I soon found myself in a bind anyway.

I summarized my research on data centers and their ecological impacts in Puerto Rico, Iceland, and the US mainland. I then transitioned to the problem of noise and the ways that noise uniquely eluded regulatory schemes. Which lead me to talk about data center regulation internationally.

"The history of data center industry is largely a story of self-regulation," I began, "it wasn't until an armada of Greenpeace blimps were floating above AWS (Amazon Web Services) in Virginia that they announced green initiatives and plans to reduce their carbon emissions. The same pattern is happening with water and now with the sound-"

Before I could finish my tirade about regulation, which the legislators in the room

seemed intrigued by, Gary interrupted me. "Not true. This is factually wrong. He clearly doesn't know what he is talking about. If you could see the reports I have to send off to the EPA every month you would change your tune."

"For your diesel generators," I replied, "which are not specific at all to the data center industry."

"Our emissions are regulated," Bob growled, "you see *this ignorance* is part of the problem."

"Your emissions for diesel generators are regulated," I continued, "the carbon footprint of your facilities' electricity is not. The grid you pull from is not renewable. The water table you draw from is experiencing a drought not seen for a century. I have plenty of evidence and scholarship that speaks to the contrary. I would be happy to email that to anyone interested."

"I thought we came here to talk about noise," Bob said. "And he's not even from here. He's not one of *us*."

Chandra cleared his throat, "Steve's point, I think, is that city noise ordinances are insufficient for data centers. We need new regulation." I was grateful to be rescued.

"Regulation is not the answer," Bob said to the legislators, ignoring Chandra, "we can work this out between us neighbors, as a community."

"If not regulation then how about transparency?" I countered, "you say noise studies were conducted. You hired a firm. Are the findings of these studies published in the public record?"

"We can look into that," The Mayor said, trying to diffuse the tension simmering everywhere.

I maintained an unrestrained glare at Gary and Bob. I knew it was unprofessional but in that moment I felt so furious and rattled. In the span of less than an hour, these men had

attempted to Other me and dismiss my credentials. This wasn't supposed to be about me. I was

supposed to be invisible. A-fly-on-the-wall. Malinowski lied. He was always in the thick of it.

Always shaping as much as he purported to describe the shape of what he saw in the Trobriands.

I wanted to storm out. I wanted to humiliate them in turn. I sort of blacked out as the Mayor and

city officials talked and a few residents complained about the hum, and then the voice of the

Mayor cut through my haze.

"Steve, do you have anything more to say?"

"Sorry we all got a little carried away," Bob said. I noted his tactical use of the collective

we to attempt to include others in his misstep.

"Well as others have said, I am an outsider here, I don't belong to this community, but I

happen to be among a handful few experts on this topic in the world," I said. It never felt so good

to say expert. "And what I hope is clear is that data centers are complex infrastructures. But

CyrusOne is not the only data center in the Valley, and yet it is the only one with international

news coverage for its hum. I have toured other facilities in this area with extensive noise

attenuation throughout and no complaints from residents. It is possible. So is the solution an

open-dialogue or something more top-down like regulation? I don't know. I'll leave that to you.

Happy to talk to anyone further about any of this."

The meeting came to a close. There were thank yous and business cards exchanged.

Martha, Brenda, and Chandra and I smiled at each other and toasted one last time before

breaking off into the slowly thinning crowd. I floated and lingered, ever the curious

ethnographer. Gary quickly disappeared but Bob stayed behind, and he surprised me by coming

over.

"You might be really interested to hear about how much water we recycle."

I nodded and listened, carefully documenting his words as he bragged about all of his engineering projects to conserve power and water in the facility. Everything from adjusting the RPM of fans to never exceed a certain power curve that makes running them inefficient, to water cooling for lower electricity consumption and the recycling of graywater for server cooling. Soon he was gone, no longer interested in me when I started asking more probing questions about sustainability and the drought ravaging the American southwest.

I went over to Chandra and Brenda, who were standing in the corner, nursing the last of their drinks. Bob migrated over to Martha and they started chatting.

"That could have gone a lot worse," Brenda said with a grin.

"You did great, Steve," Chandra said, rubbing my back.

"Thanks for saving me," I smirked, "but hey if people aren't heated we aren't doing our job, right?"

We laughed and noncommittally planned a debriefing reunion. I promised to type up the minutes and waved to Martha who was too engrossed with Bob to notice, before making my way to the car.

[Sound of car parking]

Well, more later. For now, I need to sleep. At least it's quieter in Mesa.

Encrypted Text Message via Signal App: July 5th 2021

Hi Steven. It's you-know-who from Chicago. Sorry I haven't responded to any of your emails. The Health Dept hearing was a bust. Don't think anyone will come of it besides some one-off lawsuits. But I think Digital Realty is pissed about all the media attention. Things have been pretty scary. I probably won't communicate with you on this number again. But let's just say, I

think they are on to me. I swear someone is staked out on my block. Been followed. Received a text message on my cell phone that has me spooked. I just want there to be a record somewhere if things get worse. I know I barely know you but I trust you with my life. You seem like a good person. Here is a screenshot of the message:

UNKNOWN NUMBER: Keep up the noise and you might end up like Kenneka Jenkins*

JAMES: Who is this?

UNKNOWN NUMBER: [Blank spaces, NO RESPONSE]

** 19 year old girl who was found dead inside a latched freezer of the Crowne Plaza Chicago O'Hare hotel in Rosemont, Illinois on September 9, 2017.

Post By ▮▮▮▮, Dobson Noise Coalition Facebook Group: July 2021

On average, how many days/nights per week does the noise from Cyrus One disturb the peaceful enjoyment of your property?

☐ 5 or more times per week?	80% >
☐ 3-4 times per week?	0% >
☐ 0-2 times per week?	20% >
Add poll option...	
👍 1	15 Votes Seen by 8
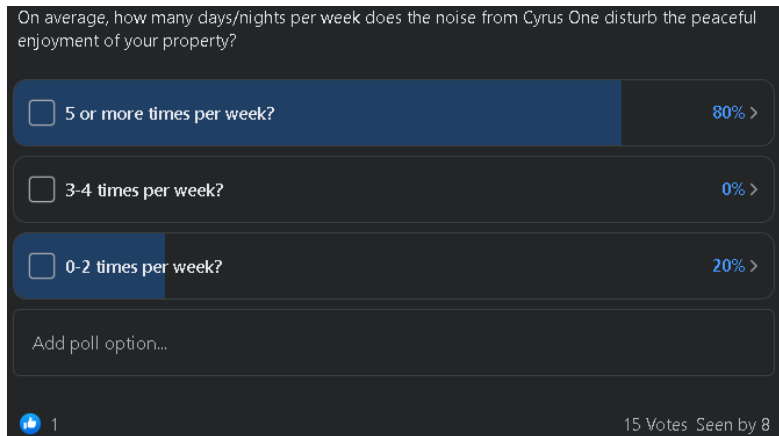
Steve: July 14th 2022

Martha sent me a message on Facebook Messenger saying "I miss you, want to catch up?". I had just received word that my scheduled Data Center tour in Phoenix had to be rescheduled so I was itching to do something "in the field". I decided to meet up with Martha at her place and we drove together to the Boyce Thompson Arboretum for a stroll through nature on a sun-scorched day.
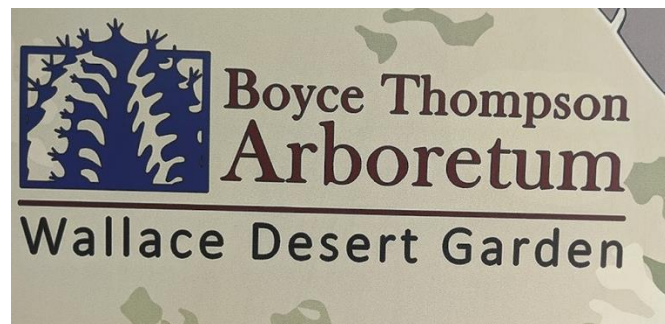
"I'm a lizard," Martha said with a chuckle, "I actually thrive when it's this hot."

"It's not bad, actually," I said, leading us down a corridor of spindly saguaros in full bloom, "I think I'm becoming something of a desert creature myself."

I remember clearly how soothing the songs of the birds were. "It's so peaceful here. You must come here often to escape the noise."

"You know I'm not really hearing it much lately," Martha said. "Are you?"

I had not visited the park in over a week so I had no opinion on the matter. But the Coalition Facebook group was still brimming with grievances as of a few days ago. Still, if one thing was clear about the noise it was how incredibly variable experiences of it were. Person to person. Neighborhood to neighborhood. Hour by hour. "Haven't been around much, but I'm glad it's better for you."

"Actually, this is my second time here this week. So glad you are up for adventures like this."

"Thanks for the invite," I said, "so do you come here alone or with Arquimedes?" It was faintly comical to imagine the bird perched on her shoulder as she explored the garden.

"Someone else, actually," Martha said, before excitedly drawing my attention to some organ pipe cactuses that looked like they were ringed with fur.

Boyce Thompson Arboretum, Photo by Author

Her phrasing and tone of "someone else" was not so much an invitation as it was a confession. I decided to revisit the topic later if it came up again in conversation as we meandered through the desert garden, startling lizards from their hiding places in the rocks and shrubs.

"Your people!" I said, gesturing to the little reptiles.

Martha smiled at my joke, "so do you mind if I ask you a personal question?"

"Sure, I'm an open book for the most part," I said, "besides it's only fair with all the

questions I ask all of you."

"Are you involved romantically with anyone?"

I don't stop to think about the ramifications, "I have a partner, yes. Long distance for now."

Martha nodded, "and how long have you been with her?"

I plod along, doing some mental math, weighing the risks with the rewards, "I've been with *him* for at least a couple of years now."

When the him escaped my lips I knew there was no turning back. I should have been more cautious. I carpooled with this woman and if she was homophobic she could have stranded me there and that would have been a nightmare to solve. But fieldwork is about risk-taking. Which is perhaps why it is such a sexist project to begin with. In most societies, men have more license to take risks and far less to lose.

"That's great," Martha said, "I sensed you were *different*."

"I am very happy," I stopped to say it. She met my gaze. "It's been a rough couple of years and I think I'm lucky to have support and affection to get me through it all."

"So he was there for you when your sister died?"

"He was."

"And how did you know? At what point did you know things would get to this level, that things might work out?"

Without the data center's hum it's easier to collect my thoughts. Perhaps I had been too much of an open book. Was I crossing the line? I wondered these things.

"I was always worried about whether it would work out. But it didn't take long for me to realize that he was the kind of person that would be right for me. Just a few months, actually."

"A few months," Martha repeated to herself as she stepped over thorny branch.

We did all of the loops and trails and Martha stopped at the gift shop to purchase some tacky saguaro stickers. Soon we were homeward bound and I knew my window of opportunity was closing, so I dared to strike.

"Why did you ask me about that earlier?" I said, "besides curiosity. You seem like you are working through something."

Martha laughed, "my mother says I wear my emotions on my sleeve."

"My mother says I'm too gullible," I countered.

After a long while of driving through Martha's "empty desert," she asked, "I have some news."

I don't speak. Silence can bloom the ripest fruit if you can withstand its painful void. Teaching taught me that. Martha didn't mind. She took the bait. "I've been seeing Bob."

The revelation left me speechless. Martha was dating Bob. Bob the Data Center Manager. Bob the "enemy". No amount of field manuals could prepare me for how to react sensibly to this. Keep people talking seems to be the most important aspect of fieldwork. So that is what I did.

"What is he like?" Open questions are better than closed yes or no questions.

"He's actually a good guy," Martha said, her cheeks red with blush. "And he is quite the lover."

I think I blinked a lot before saying, "I'm happy for you." It felt scripted but it was safer than any committal statement. The next ten minutes were quieter. But Martha offered a few tidbits about their courtship. Bob made her feel special. Bob was romantic. Bob brought her flowers. Bob liked her bird. Bob bought her bird a toy. Bob was…toying with her? My head was spinning. I tried to stay in the present but I kept drawing up conspiracy theories. Before dropping

me off at my car, Martha decided to stop at Chuparosa park. She urged me to get out for a minute and we walked over to the water fountains.

"See what I mean," Martha said, "you can barely hear it now."

I nod, but I doubt. The ringing is still there. As loud as ever.

Post By ███, *Dobson Noise Coalition Facebook Group: July 2021*

Is that the data center I hear humming annoyingly this morning? I'm almost all the way to Alma School and it feels like my house is vibrating.

Steve: August 15th 2022

It took a few weeks to bring the band back together. Chandra, Martha, Brenda and I, reunited at last. It is a bittersweet occasion as my fieldwork is coming to an end, and family vacations and other planned trips mean that I wouldn't get to see them again together after tonight. We toast to our triumphs. Brenda shows me an email from CyrusOne. They added the Dobson Coalition as a customer as promised. We don't dwell too much on what was promised and what lies ahead. We focus mostly on the weather and vacations and other small-talk. Martha has too much to drink.

"I don't really hear it anymore," She blurts out abruptly, "and I'm so glad we did all this, but I think I don't want to put any more energy into this. I just want to be friends now."

"Of course, Martha," Chandra says, "we're so grateful for everything you did for us."

"What do you mean you don't hear it?" Brenda frowns.

I look at Brenda and she sees something in my eye that gives her pause.

"It's just a little noise," Martha says, "but that's life."

I see Brenda and Chandra exchange glances.

"Are you alright, Martha?" Brenda leans forward.

"I'm fine," Martha says, tears welling in her eyes, "But I gotta run now. Going to catch a movie."

She hands me a wad of cash for the bill and heads out. She smiles and hugs each of us and the tears flow unrestrained. "I get emotional when I'm happy," She says as Chandra asked if she was sure she was alright.

When the door shuts behind her. Brenda turns to me. She knows I know. She knows I know something she doesn't. I feel like a roadrunner caught in the jaws of an overgrown Gila monster. I had been told something in confidence. I had been entrusted with a secret, but I never swore not to tell. I never signed a non-disclosure agreement with her as I had the data centers I studied.

 "What was *that* all about?" Chandra asks me. "I'm worried about her."

"You should be," I drain the last of my margarita, licking the salt from the rim.

"You know something."

"I do."

Here was my last chance to back out of the corner I had been pushed into. But in the end, I had to take a side and I had already done that long ago. Sure, I was an Anthropologist. Sure, I was a "disinterested" observer. But I had chosen to listen to them. And listening is always about power, the power to hear and to be heard. Jennifer Hsieh calls this *sonopower* (2021). And as problematic as their narratives of ruptured white suburbia were, where peace and quiet might as

well be code for white and quiet, they were victims of digital capitalism's excesses and externalities. The clamor of the Cloud was not their fault. It's Bob's fault. And Gary's fault. And everyone at CyrusOne at the highest levels who chose not to attenuate from the earliest design and construction phases. It is the fault of politicians and regulators and capitalists who incentivize the construction of thirsty, power-hungry data centers in a drought-stricken desert exacerbated by climate change. Marx's metabolic rift.

"Martha has been romantically involved with Bob."

The words flow out easier than I expected. I brace myself for the backlash, for ire stoked by her betrayal but for a moment there was only silence.

"Don't worry, Steven, we'll take care of her," Chandra says to me, his eyes narrowing. I had never seen him so emotive before. "She's lonely and vulnerable. I know she doesn't have a lot of friends. He saw that and he's taking advantage. These people at CyrusOne are truly sick. There are no levels that they won't sink to."

I am struck by Chandra's immediate enlistment of compassion. Brenda is less warm.

"How long?" Brenda asks, her voice steeling. I wonder if she is referring to how long I had known or how long they had been dating.

"Shortly after the community meeting."

"Now that I think of it she did stay a while after to schmooze with him," Brenda says, puzzling over Martha's treachery.

"She is bowing out because she doesn't want to betray us," Chandra says, "some part of her is still with us."

"Who knows what she has already told him," Brenda sighs, referring to future plans I won't mention here.

"Now there are three," Chandra says looking around. "And then soon you'll be gone."

"I might be gone from the Valley, but I'll always be just a Cloud away."

We chuckle together and raise our glasses. As I drain my margarita, I find I am still conflicted about my decision. Would it have been better to remain silent?

Cacophonic Archaeologies: Class-ifying Noise

In the heart of a sleepy suburb, nestled between a park and several gated residential communities, lies a data center. The cacophonic hum it produces haunts nearby residents. They call it *noise pollution*. They turn to authorities to put an end to the racket, but the police cannot intervene, because the digital's din does not violate noise ordinances. From a legal standpoint, it is *sound*, not *noise*. Residents dispute this ontological distinction, insisting that data center hum is *noise*, not *sound*. They dial 911. They flood the inboxes and answering machines of their local officials with complaints and documentations of their suffering. Their perception between *sound* and *noise* is shaped by what Kenneth Pike might call an "emic" perspective (1967). In this perceptual scheme, the cars whooshing up and down Dobson boulevard are not subject to similar scorn, revealing the impossibility of an 'etic' definition of *noise*. Why is a particular mechanical whoosh or beep or hum perceived as a pollutant rather than an ambient sonic phenomenon? Who gets to decide what is *noise* and what isn't? The answers to these questions are both historical and political, requiring a deep delve into the history of sound, what Michel Foucault (1970) might call an "archaeology" of the sonic episteme.

Some argue that "the world has always been loud" (Thompson 2002, p. 115), that *noise* is as old as human civilization, what Ascensión García Ruiz characterizes as the "first environmental pollutant" (Garcia Ruiz 2019, p. 128). The clatter of humans in their ancient cities

infuriated the Akkadian Gods, resulting in the great flood depicted in the *Epic of Gilgamesh* (circa. 2000-700 BCE), the oldest tale in recorded history (Kovacs 1989). Complaints about noise can be found in Buddhist scriptures dating back to 500 BCE or in the streets of Pompeii, in graffiti that taxonomizes the cacophony of urban life – everything from wheelbarrows to barking dogs (Garcia Ruiz 2019; Hartnett 2017, p. 36-37; Hendy 2013; Thompson 2002, p. 115, Zaner 1991). In the biblical account of the Battle of Jericho, noise is figured as a stratagem of war, as the walls of the ancient city were said to be destroyed using trumpets (Garcia Ruiz 2019, p. 128). These examples might suggest a link between noise and urbanization, (Thompson 2002, p. 115), but such a framing would not explain why the cars whooshing up and down the Chandler boulevards at fifty miles per hour are not framed by Chandler residents as *noise*. Why is the Cloud's clamor exceptional?

Marina Peterson defines *noise* as an "entanglement of air-body-matter", a rendering which suggests that noise is simultaneously material and phenomenal, or as Peterson frames it, "atmospheric" (2017, p. 69). In this 'weird realist' account (2021, p. 91), noise is always "entangled with a listening self" (95) and is thus inherently intersubjective as it inhabits the space between "regimes of the sensory and the sensible" (2017, p. 70). Such a framing, akin to other new materialist approaches (Bennet 2010) that insist on more-than-human agencies as a corrective to the nihilism of social constructivism (Latour 2007), cannot explain why whooshing cars on the street are mere sounds and not "noise". Indeed, Peterson's argument hinges on a narrative that "noise" is material or "atmospheric" in ways that perhaps "sound" is not. Rather than seek out universalizing definitions of sound or noise, I 'stay with the trouble' (Haraway 2016) of the car-Cloud paradox, invoking the words of one of the Dobson Noise Coalition

incensed Facebook group participants to illustrate the semiotic permeability between these two related but oppositional terms:

The *noise* tonight came in *waves*.

In the remark above, the aggrieved commenter invokes a sonic metaphor to describe the aesthetic quality of a *noise*. The data center's oscillating hum is likened to that of oceanic waves crashing on a seashore. Stefan Helmreich writes that the "sonic phenomenology of the breaking wave is relational, made by a perceiving (and hearing!) subject who is a live player in making manifest and meaningful the noises of waves as 'wave sound' – progressive repetitive, dissipative, tidalectic," (2018, p. 212-213). For this commenter, the drumming and sizzling of a distant surf is not a torturous sound, not *noise*. There is, however, an iconic resemblance to the patterning of oceanic waves, alternating intervals of intensity, that mirror the tides of digital droning lapping over Chandler (Helmreich 2018; 2023). This ontological slippage is remarkable because it situates sound and noise along a continuum (sound-noise). Below, I include a simple visualization of the data center hum as a waveform file rendered in Audacity, one of numerous recordings I captured on-site or sampled with permission from the Dobson Noise Coalition Facebook page archive:
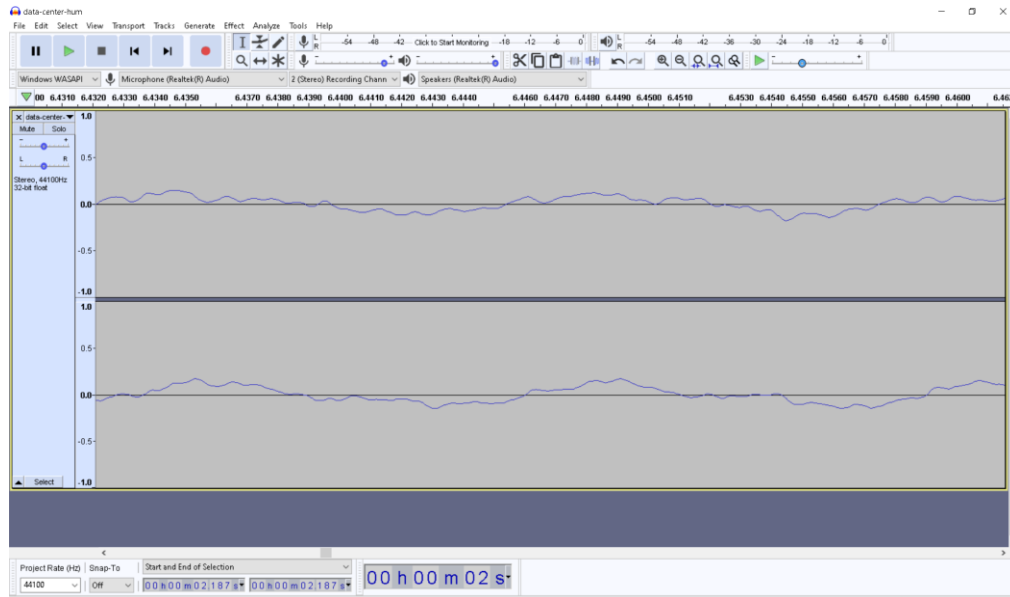
Waveform visualization of recorded data center hum, Screenshot by Author

The visualization 'iconically' (Peirce 1932) supports the social media contributor's observation that "the noise tonight came in waves", but adds another layer to Peterson's "atmospheric" framing of noise-sound. Just as waves are multivalent metaphors with semiotic currents that plumb the depths of everything from astronomy, to epidemiology, physics, and sound (Helmreich 2023), noise too is a *metaphor*, with multisensory resonances. Sound-noise is phenomenally apprehended through what Heather Paxson calls "synesthetic reasoning", a term Paxson uses to describe the *multisensory* expertise employed in artisan cheesemaking (Paxson 2012). Sound-noise is "entangled" (Peterson 2021) in more-than-auditory visual, haptic (Roosth 2018, Trower 2012), olfactory, and gustatory regimes.

Thus, the car-Cloud paradox cannot be solved unless we dispel the notion that sound-noise is uniformly experienced. Scholarship that bridges sound studies with Deaf studies reveals the ableist bias that pervade definitions and framings of sound's materiality and phenomenality

(Friedner and Helmreich 2012). Sound is always more-than-audible, but even its audibility is the result of semiotic attunement. Like language, sonic experience is mediated through history, culture, and politics. Speaking to this sonic relativism, Xochitl Gonzalez frames *noise* as an "aesthetic" (2021), implying that what counts as noise is a matter of taste. This gustatory approach to *noise* is useful for making sense of how *noise* has become adopted as a metaphor, like Helmreich's waves (2023), to describe signal interference or junk data in a range of disciplines and practices (Helmreich 2016). Noise is counterposed to information (Kane 2019; Krapp 2011; Nunes 2011). Noise is the chaos that slips into the seams of sonic orders (Zwintscher 2019). Sometimes noise is a glitch, an 'indexical' other (Silverstein 2005) defined in opposition to relevant signals, as Rosa Menkman articulates below in their Glitch Studies Manifesto:

noise has been isolated to the different occasions in which the static, linear notion of transmitting information is interrupted...In the digital, these interruptions can be subdivided into glitch, encoding / decoding (of which in digital compression is the most ordinary form) and feedback artifacts…The meaning of noise is more complex than can be explained by information theory; the 'meaning' of noise differs according to perspective. Etymologically, the term noise refers to states of aggression, alarm and powerful sound phenomena in nature ('rauschen'), such as storm, thunder and the roaring sea. Moreover, when noise is explored within a social context or in art, the term is often used as a figure of speech, and possesses many more meanings. Sometimes, noise stands for *unaccepted* sounds; for that which is not music, not valid information, or is not a message. Noise can also stand for an (often undesirable, unwanted, other and unordered) disturbance, or a break or addition within the linear transmission of useful data. However noise is defined, its negative definition also has a positive consequence: it helps to (re)define its opposite, which is the world of meaning, the norm, regulation, goodness, beauty and so on. (Menkman p. 339-340, emphasis my own)

As Menkman intimates in the context of visual art and music, *noise* is aesthetic discord that prefigures an opposing harmonic order; sound, signal, data, information. This reading of noise as "aesthetic" (Gonzalez 2021), is central to the performers and creators of "noise music" (Helmreich 2018, p. 213; Schafer 1993), a genre of synthetic, electronic music that more than faintly resembles CyrusOne's mechanical clamor. Intrigued by this resemblance, I sought out the counsel of Dr. Matt O'Hare, an artist-in-residence and Visiting Assistant Professor of Visual Studies at Haverford College, who was delighted to help me interpret my field recordings and samples of the data center's hum. Fiddling with various dials, sliders, and sound boards, O'Hare transformed the monotonal drone of the data center into an oscillating cyborgian rattle, shifting the tones, reverb, and tambor to resemble one interview respondent's sensory description of "feeling underwater". O'Hare's conversion of the data center's noise into "noise-music", his deliberate recalibration of the base waveform audio files into a watery and wavy score, reifies the intersubjectivity and semiotic contingency of sonic experiences. Stefan Helmreich describes this multisensory refraction as "transduction" (2009). For O'Hare, the samples of the Cloud's clamor I brought were precisely the kind of "found" sound elements he might use in his compositions, inviting the proposition that one man's noise is another's music.

Sampling Data Center Noise Pollution to create "Noise Music" with Matt O'Hare, Artist-in-Residence and Visiting Professor of Visual Studies at Haverford College, Photo by Author

Just as Rosa Menkman invites creatives to inhabit the interstice and abhorrence of the glitch, Andrew Brooks calls upon sound studies scholars to think of the subversive and liberatory potential of glitching as an epistemological practice that queers and contests hegemonic sonic orders (2015). Similarly, O'Hare deliberately samples and reinterprets sounds that might be deemed by many as "noise" into music, contesting aesthetic regimes that privilege harmonic intervals and repeating structures that evoke a telos (ex. verse, pre-chorus, chorus, bridge). In these settings, *noise* is trafficked as a disruptive metaphor, an opportunity to intervene or reshape dominant aesthetics. In these contexts, the essence of noise is ultimately semiotic, not auditory:

Noise is not just volume, but the spread, dissemination and dispersal of its non-message, the poverty and ruination of its materials, the end result of which is uninhibited and no longer distinguishes truth from falsehood, simulacrum from reality—simultaneously transcendent and utterly confusing because it confounds all previous experiences. (Zwintscher 2019, p. 74-75)

A semiotic approach to the car-Cloud paradox would entail mapping the particular sonic qualities of cars versus Cloud in an effort to understand how the Cloud's sounds "index" noise (Parmentier 2016; Peirce 1932). What specific features of the sound are "iconic" of noise

(Mannheim 1999)? How do they resemble in style or structure or tone or rhythm, other sounds ratified by a semiotic community as "noise"? In this reading, *noise* is what Michael Silverstein might refer to as an 'iconic-indexical', a thing that structurally resembles a particular quality salient to a specific community (ex. waves) while also pointing to an associated phenomenon (like smoke issuing from flames) (2005). While these approaches were conceived of to describe properties of language, they are a useful starting point to make sense of the material-phenomenal-semiotic "waves" of sound-noise in Chandler and beyond.

Pierre Bourdieu's concept of habitus reminds us that our desires, mannerisms, gaits, and microscopic comportments are tuned by our class position and cultural milieux (1987). Following this, noise and sound can never be understood as universals divisible from class experiences. They are ever-shifting and relentlessly specific to the "culture of listening" (Thompson 2002, p.2) from which they emerge. In one world, silence is soothing and comfortable, in another, it is vacuous and frightening (Gonzalez 2021). It would follow then, that one person's noise could be another's silence. All this variation across axes of identity and history, suggest diverse sonosubjectivities (Hsieh 2020). For Jennifer Hsieh, the key to solving the car-Cloud paradox might be an approach called "sono-sociality":

Sono-sociality, on the other hand, examines how sonic experience regroups social and political life around the material qualities of sound and hearing… sono-sociality serves as an analytic to identify relational processes in everyday deliberations of sound. Not limited to the physiology of hearing, a sono-social analysis examines how the sonic domain is incorporated into social interactions that convey multiple ways of listening, various attempts to communicate sound to others, and actual relations created by sound. (53)

Sono-sociality thus refers to how communities form around shared experiences of audibility, in the case of Chandler, their shared sense of torment or annoyance with the hum of the CyrusOne data center. The Facebook group feed is updated every few days with informal incident reports, which log the date, time, severity, and quality of the sonic disturbance, building an archive and shared knowledge base from which to draw as they battle CyrusOne, the city of Chandler, the state of Arizona, and the US government for remediation:
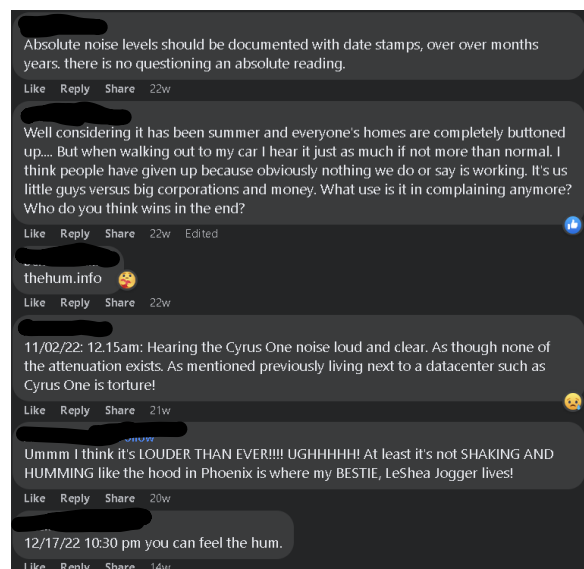
Facebook Group Posts, Documenting "Noise Incidents"

This meticulous documentary practice, best typified by Chandra's detailed posts, reveal how the noise is not only a shared nuisance, but also an epistemological prism for a phenomenon that has thusfar evaded regulatory schemes. Steven Feld coined the term "acoustemology" to describe how sound is operationalized into a "a way of knowing" (2015, 12). This practice of citizen-science style documentation might be thought of as "acoustemological". After "independent" sound studies commissioned to verify the legality of CyrusOne's ambient noise found that the facility was operating well within legal decibelic parameters, disgruntled residents have taken to

social media to build a counter-archive. They enlisted my help to construct a data collection portal via Google Forms. What they hope to reveal is the fluctuation of the data center hum over time but also the geographic variability of their experiences in the cul-de-sacs and streets of their gated neighborhoods. They are constructing what Emily Thompson describes as a "soundscape":

"Like a landscape, a soundscape is simultaneously a physical environment and a way of perceiving that environ- ment; it is both a world and a culture constructed to make sense of that world. The physical aspects of a soundscape consist not only of the sounds themselves, the waves of acoustical energy permeating the atmosphere in which people live, but also the material objects that create, and sometimes destroy, those sounds. A soundscape's cultural aspects incorporate scientific and aesthetic ways of listening, a listener's relationship to their environment, and the social circumstances that dictate who gets to hear what" (2002, p. 1-2)

As Thompson writes, soundscapes highlight "aesthetic ways of listening" (2002, p. 1-2) and the relationship of listeners to their environments. After unanswered calls to the police and failed attempts to shut down CyrusOne through existing legalistic mechanisms, Chandler residents are re-class-ifiying *noise*. For them, the novel hum of data centers is sonically incongruent with their auditory aesthetic of middle-class suburbia, a fantasy of a quieter past that has since been ruptured by the arrival of CyrusOne. To return to the car-Cloud paradox, it would seem that a better question to ask is how did automobiles become *inaudible* as noise? When did their whooshing become reclassified as *sound*? For some answers, we must reach back a century, to the decade that was said to roar.

The Roaring Twenty-twenties: (Post)modernity's reverb

Emily Thompson writes that "the keynote of modern civilization…[is] clamor" (2004, p. 115). While the history of noise can be traced back to the bells and blacksmith booms of ancient cities (Hendy 2013, p. 105-106; Thompson 2004, p.117; Zaner 1991), Thompson and others (Hendy 2013) argue that twentieth century modernity was a turning point, the inauguration of an "Amplified Age" (Hendy 2013, p. 282) that is "defined by [the] din" (Thompson 2004, p. 117) of industry, automobiles and airplanes, radios, telephones, subwoofers, sonic booms (Goodman 2012) and computers (Asarin and Collins 2005). Twentieth century civilization became defined by its audibility; a "Big Noise" that signified progress (Thompson 2004, p. 120) and increasing tensions between rural and urban life, "nature" and "society", the destitute and the affluent. In the American context, a sense of disquiet with the shifting sonic milieux of modernity permeates the writings of Victorian-era essayists like Thomas Carlyle:

The sound of the railroad…became a new source of complaint. The noise of its steam whistle was disturbing not only for its loudness but also for its unfamiliarity. Carlyle could only express his distress at its mechanical scream in terms of his old, familiar enemies, comparing it to the screech of ten thousand cats, each as big as a cathedral. Over the course of the nineteenth century, the clanking din of the factory, the squeal of the streetcar, and other new sounds were increasingly incorporated into the soundscape…To those who lived through that transformation, the change was dramatic and deeply felt. Some were energized, others enervated; all felt challenged to respond to the modern soundscape in which they now lived. (Thompson 2004, p. 116-117).

At first novel and alien, "modern" sounds became gradually incorporated into ambient soundscapes by communities of listeners, through a process of sonic domestication over the span of generations as listening cultures shifted (Thompson 2004, p. 120). Still, some urban sounds proved to be particularly difficult to assimilate. This was especially true for affluent New Yorkers in the decade known as the roaring twenties. A *New York Times* contributor remarked

that "the machine age has brought so many new noises into existence, the ear has not learned how to handle them" (Thompson 2003, p. 149). Statements such as these indicate that *noise* is not only defined by its loudness but by other qualities like tone, as evidenced by Carlyle's discontent with "shrieking" steam whistles.
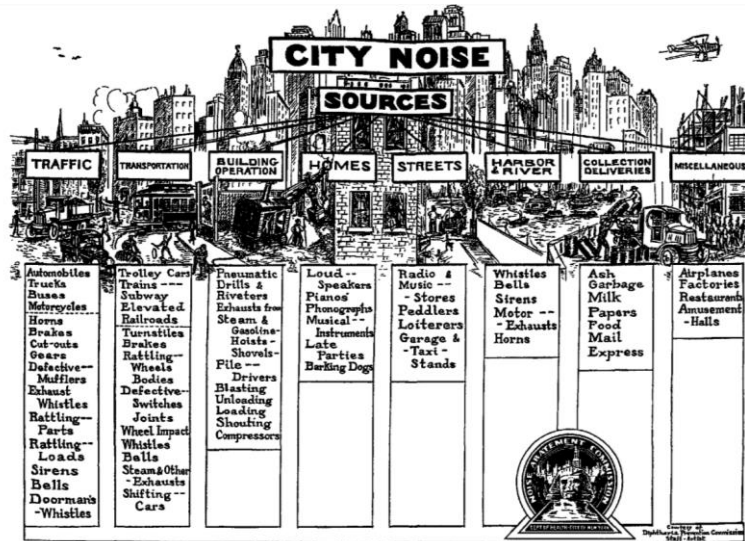
Excerpted from Soundscapes of Modernity (Thompson 2004, p. 118)

David Hendy theorizes that modern *noise* became equated with "consumption", "the unavoidable byproduct of material progress" (2013, p. 305). In 1925, the height of the roaring twenties, the *Saturday Review of Literature* described the soundscape of New York City:

The air belongs to the steady burr of the motor…to the chitter of the steel drill. Underneath is the rhythmic roll over clattering tiles of the subway; above the drone of the airplane. The recurrent explosion of the internal combustion engine, and the rhythmic jar of bodies in rapid motion determine the tempo of the sound world in

which we have to live (Thompson 2004, p. 117).

Doctors expressed concern about the impact of this sustained noise on public health, while "efficiency experts" lamented the "deleterious effect of noise upon the nation's productivity" (Thompson 2004, p. 118). In 1929, New Yorkers ranked their most loathsome sounds in a survey, citing "the relentless roar of street traffic" (Hendy 2013, p. 305) as the greatest nuisance in their lives. A century later, Chandler residents have all but forgotten this distaste for whooshing cars, instead fixating their aural attention on CyrusOne's ever-humming data center. Its "noise" is the waste product of twenty first century postmodernity; payroll; emails; video streams; shares; likes; online sales; and everything from ZOOM calls to Chatbots– all housed in what resembles an ordinary office building.

Data center construction, however, is anything but ordinary. Data centers are designed for security, hyper-redundancy, and integration with water and electrical infrastructures to power and cool the servers they house (Mayer 2023; Velkova 2019). CyrusOne claims to have implemented sound attenuation and mitigation measures in the form of insulative blankets over their chiller equipment to dampen the sound emitted to nearby neighborhoods. But this was long after the facilities had been built. This attenuation effort appears to have failed, echoing previous failures at industrial sound abatement a century earlier in New York City.

Philadelphia Saving Fund Society Building, downtown Philadelphia, Photo by Author

1930s architects and acousticians, responding to the cacophony of the 1920s, sought to better understand sound to design quieter buildings (Thompson 2004, p. 2). One particular technique pioneered by this "New Acoustics" movement was the elimination of reverb (p. 3). Emily Thompson crucially links the history of sound engineering to the history of architecture, demonstrating how qualities like "soundproofing" (p. 119) and "nonreveberance" (p. 9) were incorporated into the materials and layouts of new buildings in an aspiration toward an "architecture of total environmental control" (p. 226). These efforts culminated in the construction of buildings like the Philadelphia Saving Fund Society Building or PSFS, which "emphasized volume over mass and regularity over symmetry, and rejected ornamentation of any kind" (p. 210, 212). This aesthetic austerity invited the ire of critics from the *Sunday Dispatch* who variously described the newly-built chrome tower as "botched", "hideous", "barbaric", "repellent", and "an affront to public taste" (p. 214).

Others like Robert Reiss celebrated its audacity and ambition as a triumph of "acoustical

technology" (p.216):

Sheer out of the Earth

The black edifice

The crowning point

Of Man's climb from the caves

This black and silver stern

Shivering in the sun

A frozen exclamation mark

In the march of time

Regular

Angular

Precise

Perfect

Calm

Cold

Frozen

Up from the city streets

In unbroken perfect

Up from the streets

To the clean air

Up from the noisy streets

The hideous clamor

To the secrecy of the upper air

The silver stillness

The quiet beauty

The fulfilled promise

Of the upper air

(Reiss 1932; Thompson 2004, p. 215)

Like CyrusOne's data center, the PSFS building was outfitted with state-of-the-art air conditioning systems, what was then called "manufactured weather" (p. 216). While hermetically sealed from the outside world with its absorptive building materials and engineered acoustics, the cooling systems of the PSFS must have been audible from the street, perhaps muffled by the ambient urban din (p. 216). A current Philadelphia resident, I have had the opportunity to stand in the PSFS building, looking out at the bustling cars, pedestrians, and airplanes that crisscross City Center, hearing little but the faint whir of ventilation systems, dampened by century-old absorptive materials designed to dissipate urban resonance. While I have not set foot inside of CyrusOne's data center, I have toured the halls of a dozen others, some of which are located nearby in the Valley of Sun metro area. While the air-conditioned halls of these facilities are loud with whir of server fans, the exterior parking lot is quiet against the ambient urban din. These particular facilities were built to anticipate the noise they might emit, borrowing from an updated playbook of the "new acoustics" from a century earlier. In one data center I toured in Phoenix, absorptive cages and concrete walls were erected to muffle the chitter of air chiller units and diesel generators.

Arizona Data Center, Artistic Rendering by Author to maintain confidentiality

The 1920s is a decade in American history also referred to as the "Golden Twenties" (Bodek 1996). Following the economic turbulence caused by World War I and the Spanish influenza, the last half of the 1920s was a period of prosperity and pronounced cultural innovation, as the roar of radios, automobiles, moving pictures, jazz music blossomed first in the cities before diffusing elsewhere (Dumenil 1995; Thompson 2004). Just like the 2020s, however, the 1920s was a period of extreme economic inequality and heightened class disparities that ultimately resulted in the Wall Street Crash of 1929 and the Great Depression (Ross 2021; Thomas 2014; Thompson 2004, p. 166). The first quarter of the twentieth century "roared", but for many the roar was disquieting. However, the only discontented voices that could influence policymakers and designers to consider noise abatement were the wealthy and the well-connected (Thompson 2004, p. 118), for common wisdom had it that "racket and prosperity [were]… synonymous" (Thompson 2004, p. 121).

A century before Chandra first filed a formal complaint to the City Manager of Chandler, Julia Barnett Rice, a socialite in New York City, decried how "the 'hum' of industry has now

made way for the shriek of industry, and it is perhaps well to call attention here to the fact that noise is not an essential part of progress" (Thompson 2004, p. 121). Like Chandra, Rice bounced from one bureaucrat, official, or authority to another, meeting resistance at every turn. Slowly but surely, she attracted the attention of other wealthy residents who detested modern noise. Her most influential ally turned out to be the medical community. Rice formed what might be a framed as a "proto" Dobson Noise Coalition, attracting the signatures of three thousand of her neighbors and garnering support from doctors for a petition against the noise presented before the Board of Health (2004, p. 121). With New York Congressman William Bennet at her side, Rice successfully paved the way for the 1907 Bennet Act, which "forbade the unnecessary blowing of whistles in ports and harbors" (2004, p. 121). Following this victory, Rice established the Society for the Suppression of Unnecessary Noise, which included "scores of prominent men and women", whose primary goal became noise prevention around city hospitals (2004, p. 121).

Over time, noise abatement campaigns intensified, framing noise as a pollutant like industrial "smoke" (122)[2]:

Noise was compared to smoke, and campaigns for noise abatement were clearly inspired by earlier efforts toward the abatement of smoke. In these campaigns, the popular perception of smoke had been transformed from an indicator of industrial prosperity to a sign of industrial waste, untapped resources, and poorly designed processes. The same rhetorical strategies were employed in the fight against noise. (122)

Just as toxic smoke was demonstrated to impede the productivity of workers by adversely impacting their health, "noise abaters" pitched the urgency of their grievances within the context

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[2] An interesting convergence of smoke and noise can be found in Chandler where the roar of Cyrus One's diesel generators is accompanied by a marked depreciation of air quality. This conjuncture is best summarized by this Facebook user's comment: "first they torture us with their noise, then they suffocate us with their smog."

of capitalist efficiency (Thompson 2004, p. 122). In due course, noise complaints became proceduralized through the Department of Health to be resolved by "sanitary inspectors" or "health squads" (p. 127). The offending noisemakers would then be brought to court, where judges would make arbitrary determinations on whether or not the offenders were guilty (p. 130). With no precise legal definition for what constituted noise, noise abaters often did not find the sonic justice they were searching for, a dynamic that would persist into the twenty-first century.

In the 1920s, the inventions of microphones and audiometers permitted the Noise Abatement Commission to determine permissible thresholds for noise violations based on audiometer tones that were loud enough to overcome ambient city noise (p. 148). They published these newly measured "sensation units" (p. 158) and "decibellic" schemes in charts that were printed in "popular magazines, educating readers about the new measure of sound as well as the noises that surrounded them" (p. 162). This triumph, however, did not translate well to abatement efforts, nor to the public, and "the language of decibels ultimately proved delusory" (p. 164). After these efforts to render sound epistemologically knowable and regulatable failed, "acoustical expertise was brought back indoors and acousticians devoted themselves to the construction of soundproof buildings that offered refuge from the noise without" (p. 119). Like the citizens of Chandler padding their windows to muffle the data center's hum, noise became something to defend against rather than to prevent.

In Taipei, Jennifer Hsieh tracks how noise continues to be "an epistemological problem" (2021, p. 52). The solution adopted by the Taiwanese government to address the challenge of sound's scientific inscrutability, was to create a "participatory approach to noise control" (p. 52) codified in the Noise Control Act of 1983 (2021). Like the noise ordinances in Chandler, the

Taiwanese approach to "noise control" is based on decibels captured by audiometers or other

recording instruments (p. 53). As Marina Peterson observes in Los Angeles with airport

acoustics, however, there are serious limitations to technoscientific approaches to sonic

measurement because "annoyance elude[s]…computation and inscription, remaining amorphous

and indeterminate" (2021, p. 50). Jennifer Hsieh uses the colloquial "yin ren er yi" to theorize

sound as a "subjective" and "perceptual" phenomenon that "varies from person to person" (2021,

p. 51). This approach could help explain why Chandra was the first to hear CyrusOne and others

in his same household were not:

It is common that only one family member in a household hears and reports noise, while the others do not hear

anything at all. Depending on the listener, the sound of piano practice is music, an annoyance, or an unbearable

affront. (Hsieh 2019, 2021, p. 54)

In addition to the subjective variability of sonic experience, the materiality of sound is not as

straightforward as it might seem. Hsieh reports how noise measurements are complicated by a

range of factors including proximity to the sonic disturbance, humidity, temperature, background

sounds (which vary depending on the time of day) and the sensitivities and resolutions of the

instruments used to measure sound waves, which like human ears, vary greatly (Hsieh 2021, p.

57).

The impossibility of an "objective" measure of noise is what leads Hsieh to

conceptualize sound as a "socially negotiated phenomenon" (p. 54). Through dialogue with

others, "the personal act of hearing" is 'transformed', where it "traverses the logic of

environmental engineering, beyond the legalistic parameters of the decibel, to the realm of

"shared discourse" (p. 54). The "sonosociality" (p. 54) that Hsieh tracks in Taiwan, more than

faintly resembles the Dobson Noise Coalition in Chandler, down to the creation of an "anti-noise

social media group with over 1,500 members" (p. 52). Just like in Chandler, these sonically-

aggrieved Taipei residents are building a counter-archive of field recordings of noise in direct

opposition to the evidence marshaled by licensed inspectors in legal proceedings:

Taipei noise hearers react to noise inspections by using and reworking the technoscientific terms of noise

measurement. In response to the inspection process, residents have taken to making audiovisual recordings of noise

that challenge, copy, and riff on the formal measurement protocols. In the style of an official inspector, residents

point recording instruments at an alleged noise source to procure evidence of a noise problem. These recordings are

dismissed by government officials as unverifiable, and those who make the recordings explain that, even with

evidence in hand, they have a hard time convincing others that the recorded sound is noise. (p. 52)

Though embedded in a different legalistic architecture, Chandler residents face a similar

dynamic wherein the sound study firm hired by CyrusOne have the final say on whether or not

the sound of their ventilation equipment and diesel generators violates local noise ordinances.

Like their Taipei counterparts, the Dobson Noise Coalition are attempting to "rework…the

technoscientific terms of noise measurement" (p. 52), acquiring decibel meters of their own to

measure in the field and elevate the legitimacy of their documented grievances.
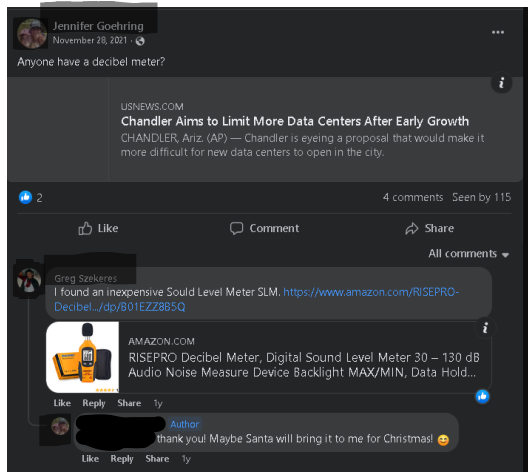
Chandler residents plot to acquire decibel meters on the Facebook Page, Screenshot by Author

Like its modern ancestor, postmodernity is noisy. The machine-driven factories that were once emblematic of twentieth century progress have largely shuttered (Walley 2013), but the clamor of capitalism is still audible. As the Chandler case study reveals, bits resonate. Computation hums. While seemingly novel, postmodernity's digital economy is still polluting, still roaring. Like its analog predecessor, postmodernity is an engine of social stratification (Ross 2021; Walley 2017). What is behind this "noise" – however it is defined – is power; Who gets to make it? Who must be subjected to it? Who gets to be heard?

White and Quiet: Theorizing Sonoracism

In the 1920s, Julia Barnett Rice set out on a quest to curtail the racket of modern life, seeking to enact noise reforms that would benefit "the sick, the poor, the city's children," and the well-to-do denizens of New York City who supported her efforts (Thompson 2004, p. 123). What ensued, however, was not a crusade for a sonic commons, but an inquisition against "relatively powerless targets…noisemakers who impeded, in ways not just acoustical, the

middle-class vision of a well-ordered city" (p. 123). Those bearing the brunt of the "iron law of silence" (p.125), were disproportionately poor or working-class street vendors who disrupted the "City Beautiful" middle-class aesthetic that Rice and her allies fought to create (p. 123). Urban planners achieved "special zones of quiet" by displacing and outlawing the presence of market stalls and street kiosks (p. 123). In Baltimore, an "Anti-Noise policeman" was hired to maintain the quiet desired by urban elites:

Over the course of one week, Officer Maurice Pease confronted and eliminated the noises of streetcar bell-ringers and squeaky-wheeled trolleys, a baker noisily unloading bread from his wagon, a shouting fishmonger, raucous school children, three roosters, six cats, another noisy baker, twenty-four more cats, newsboys, a scissors grinder, and several rag-and-bone collectors. (p. 126)

These islands of quiet, created by displacement and zoning legislation, were successful in dampening urban sound in particular areas near parks or hospitals but were less helpful for addressing the quotidian noise of street traffic that annoyed so many city residents. This resulted in a dynamic wherein the "acoustically aggrieved" had to appeal to general nuisance laws to achieve sonic justice (p. 127). They were, "on their own", like the residents of Chandler. They maneuvered the administrative and juridical machinery of the state to silence the source of their annoyance. Many of them failed, but those that achieved anything at all, had one thing in common: their class position. "Acoustically aggrieved" Chandler residents, like their urban counterparts in 1920s New York and Baltimore, enjoy a position of socioeconomic privilege that grants them the time, resources, and social station to attend hearings and community planning sessions, call the police to address noise complaints without fear of reprisal or carceral violence against them, and attract the attention of national news outlets to cover their plight (Bosker 2019).

Data Center Protesters in North Virginia, Image: Dale Brown, Fauquier Times

In an exposé on Chandler's data center noise published in *The Atlantic*, Bianca Bosker concludes that "noise is never just about sound…it is inseparable from issues of *power* and powerlessness…it is a violation we can't control and to which, because of our anatomy, we cannot close ourselves off" (Bosker 2019; emphasis mine). While Bosker and others site the hearing body as the locus of that powerlessness (Bronzaft 2017, p. 108), Jennifer Hsieh argues that "sonopower" flows from the state to its citizenry (2021, p. 53). In Taipei, the hegemony of the "noise-measurement apparatus" – noise inspectors and their instruments – is continually contested by citizens and the counter-archive of sonic harm they have built as they thread the needle to negotiate "Taiwan's authoritarian past with its liberal-democratic present" (p. 53). The "sonosocial" movement that appears in Hsieh's ethnography strives to reimagine the "discursive, material, and ontological status of noise" but also subvert the state's disciplinary apparatus, which Hsieh extends to the realm of sonic surveillance and sonic weaponry (p. 53-54). The Dobson Coalition similarly argues that the state is partly to blame for the noise issue. However,

the CyrusOne corporation and the broader changes in society that they associate with the digital

age is viewed by many as the true culprit.
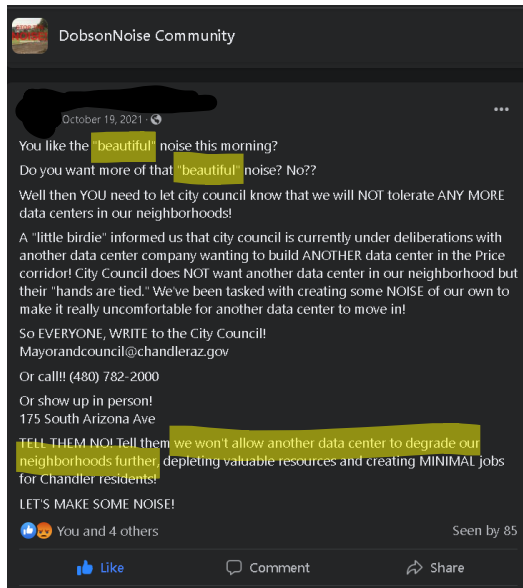
Chandler residents organize a protest against further data center construction, Screenshot by Author with added emphasis

In the screen capture above, Chandler residents call for their neighbors to join them in

protesting further data center construction, ironically invoking the word "beautiful" to describe

data center noise. In this strange echo of the "City Beautiful" campaigns recounted by Emily

Thompson a century earlier (2002), Dobson Coalition members warn against a future where new

data centers might "degrade [their]…neighborhoods further". This lexicon of "degradation"

pervades many posts in the Dobson Coalition archive, where one contributor called for the data

centers to go elsewhere in the valley so that others could "share the downside" of having a

"stupid garbage DUMP across the road". These comments remind me of conversations I had

with Brenda, where she explained that her reasoning for moving to Chandler (prior to the arrival

of CyrusOne), was to escape the "riffraff" of the city. For Brenda and the others, Chandler is a

paradise lost; a suburbia unraveling into a "ghetto" (as one user lamented), "degrading" as the

clamor of the Cloud intrudes into its once "peaceful" quiet. The implication being that the noisy "garbage dumps" of CyrusOne belong with the "riffraff" of the city's working-class and poor neighborhoods, who should "share the [sonic] downside" with their suburban counterpart.

As Janet McIntosh observes, modernity is often "raced as white" (2016, p. 214). The ruptured Eden that Chandler represents for Dobson Coalition members mirrors a perceived culture war aimed at dismantling whiteness in the wake of #BlackLivesMatter (Beltrán 2021; Bonilla and Rosa 2015). Gustavus Stadler argues that the 'wonder' of modernity was always "an implicitly white experience", which is reflected in the uncritical engagement with the categories of "listener", "body", and "ear" in the field of sound studies (2015). Following Stadler's argument, I seek to excavate the "audible contour of race" (Stoever 2016; p. 6) embedded in the experiences and discourses around the data center's hum in Chandler, a predominantly white suburb of the Valley metro area. Given that a small number of the Coalition organizers are nonwhite, the use of Jennifer Stoever's "sonic color line"[3] (2016) in this case is somewhat complicated, especially if we rely on an uncritical definition of whiteness. Melissa Steyn offers a taxonomy of "whitenesses" (2001) to think through the complicated racial politics and phenomenological experiences of South Africans in a post-Apartheid state. Christina Beltrán introduces "multiracial whiteness" to explain why white supremacist organizations like Proud Boys have nonwhite members among their leadership ranks (2021). This approach is particularly useful for the Chandler context, provided that most of the coalition members identify on the right end of the political spectrum.

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[3] The sonic color line echoes W.E.B. DuBois's oft-cited declaration that the fundamental issue of the twentieth century is the problem of the color line.

Joe Biden Says 'Poor Kids' Are Just as Bright as 'White Kids'

Former Vice President Joseph R. Biden Jr., whose record on race has been under scrutiny, appeared to make a gaffe by saying, "poor kids are just as bright and just as talented as white kids," during a town hall hosted by the Asian & Latino Coalition. Erin Schaff/The New York Times

As Beltrán argues, whiteness is not ontologically fixed, it is first and foremost a "political project" (2021) like "City Beautiful" or Jim Crow. Joe Biden's viral gaffe (featured above) at a town hall hosted by the Asian and Latino coalition, reveal the way that whiteness and class are so thoroughly interlinked that they are often conflated (Martin 2021; Walley 2017). For Chandler residents, the narrative of a paradise lost is connected to a wider sense of dissolution precipitated by identity politics and digital culture. The data center is understood as the engine behind the social media that is "poisoning the minds of their kids" says Dana, a coalition member. In our conversation, Dana situates the data center as an accomplice in the widening erosion of society's moral fabric as "the extreme fascist left" pushes for "mask mandates" and "critical race theory" in schools which "weaken the nation" by "teaching kids to hate it". This anti-corporate view is in tension with the general pro-business, pro-capitalist stance of the Republican party. They detest the noise that data centers emit but they concede the need for the services that they facilitate — services that include the hosting of their Facebook group page. Coalition members at times must navigate this tricky paradox, never calling for the outright abolishment of data centers or digital capitalism, lest they sound like the prison abolition movement that they stand so firmly against.

Instead, their imagined solution to the data center noise issue is the relocation of the Cloud to "lesser" elsewheres. Anywhere but their Chandler.

In our conversations, Brenda, Martha, Chandra, and others often refer back to that distant time before CyrusOne appeared in their community, a time of "peace and quiet", in the words of Martha. Xochitl Gonzalez reminds us, however, that the notion that "silence is an aesthetic to be revered" is cultural and historical, not universal (2022). In a comprehensive study of the events leading up to the Amplified Noise Act (ANA) in Washington, DC, Alison Martin observes that "processes of gentrification include an amplification of tensions surrounding sound, music, and noise in both public and private space, and that these tensions are deeply racialized because of the ways in which Black people have long been deemed sonically unruly and unmanageable" (Martin 2021, p. 105). Martin's approach to illuminating the racial dynamics of "sonic gentrification", is a "speculative method" (p. 108) called "intersectional listening" which "engages and seeks to disrupt the interlocking matrices of power that are sonically articulated during processes of gentrification, producing an analysis that attends to the complexities of sound and power in a changing city" (p. 105). Commenting on the process of gentrification in contemporary Brooklyn, González recounts how:

The people complaining clearly thought they were trying to enforce a sonic landscape that they deemed superior, but what they were really doing was using shame to exert control. Over the restaurant, the building, the borough. Us…New York was effectively codifying an elite sonic aesthetic: the systemic elevation of quiet over noise. (2022)

This "elevation of quiet over noise", is particularly insidious in our political moment (Bonilla and Rosa 2015), Martin observes, one in which "protesting and making oneself heard have become more normalized in the public sphere" (2021, p. 105). For Martin, listening

'intersectionally' is about hearing the signatures of displacement and black erasure that follow from gentrification, a process "that is deeply rooted in racialized and classed ideas of desirability, development, and progress" (p. 106).

Like the aggrieved residents of Chandler, proponents of the Amplified Noise Act in DC characterized the sound of "brass bands and drum sets" in black neighborhoods as "music torture" (p. 113), activating a long history of the criminalization and derision of black "sonic practices" (p. 105, p. 118). A century earlier in New York and other cities, jazz music was attacked by commentators for its mimicry of the mechanistic sterility of modernity's "din" (Thompson 2002, p. 144) and for "returning civilized people to the jungles of barbarism" (2002, p. 131). Jennifer Stoever traces these sonoracist sentiments back to the antebellum period in America, locating in runaway slave ads sonic qualities attributed to blackness which include "loudness", "coarseness", "strength" (2016, p. 30), and to quote Martin, sound "out of place" (2021, p. 105). White supremacy did not spare the acoustic domain, incorporating "new forms of acoustic disciplining that punished racial transgressions and served as violently coercive psychological conformity" (Stoever 2016, p. 36). Stoever argues that this white disciplining project, "the listening ear" (p.32), came to be internalized by black people and continues to influence their sonic subjectivity today (p. 83), in a world where it is dangerous to be black and exist in white spaces.

The Dobson Noise Coalition, aimed at preserving an idyll of white suburban quiet, a brand of the American dream predicated on "white exclusivity" (Martin 2021, p. 122), is diametrically opposed to the #DontMuteDC movement, which strives to preserve black sonic expressivity in a rapidly gentrifying historically black city. Unlike Brenda or Martha, the black

residents who makeup the majority of the #DontMuteDC movement cannot turn to the police to pursue justice for the silence encroaching upon their world. A silence that is "deafening" (Stoever 2021, p.3), because it is shrill with the displacement of Black residents and the centuries of violence inflicted upon their communities by slavery, Jim Crow, and what Ruha Benjamin calls "the New Jim Code" (2020) of technologically amplified racism. As Martin elaborates below, the underlying disparity between these two cases of sonic injustice is that the first is premised on an undisputed claim of belonging and an entitlement to rights within the criminal justice system while the latter is merely arguing for the right to exist:

White people call the police on Black people at Starbucks, at neighborhood pools, for selling lemonade, sleeping in university common rooms, standing out of the rain, mowing lawns, for simply existing in "white" spaces. White spaces require a kind of exclusiveness, a kind of private attitude so that Black people can be labeled unwelcome. Gentrification is one of the worst instances of this practice because whiteness then claims a space that was (or still is) inhabited by Black people…White spaces, much like whiteness itself, demand an exclusivity related to control and policing. (2021, p. 122-123)

Perhaps this "exclusivity" with regard to "control and policing" is one of the principal sources of discontent that animates the Dobson Noise Coalition. While there is substantial evidence to support the coalition's claims of biomedical and psychological harm as a result of long-term exposure to data center "noise pollution" (Abek 2015; Anees 2017; Bronzaft 2017; Bronzaft and McCarthy 1975; Casey et al. 2017; Lee et al. 2018; Molina 2021), it is clear that a sense of injustice is what animates their fury above all else. As white suburban residents, they are accustomed to a carceral state that supports their interests and does their bidding. Given their structural and racial privilege, they seldom experience complaints unanswered or appeals for justice ignored by the authorities that are supposed to serve them.

Commander Edward Upshaw, Chandler Police. Photo by Cassidy Araiza via the Atlantic

"We have a black police captain," Martha told me once, when I inquired about the racial

dynamics of Chandler. "Everyone is welcome here," Brenda added, as we slurped down frosty

margaritas at the local Mexican restaurant. It was at that moment that I wondered why

Commander Upshaw, who despite receiving frequent 911 calls from residents stated to a reporter

that he was confident the data centers would never receive a citation (Bosker 2019). Was he

administering his own brand of sonic justice, ignoring what he perceived were trivial claims of

injustice, standing in the way of Brenda and her brigade of critical race theory deniers? I never

had the opportunity to interview him, my calls went unanswered.

Disquieting Resonances, Cloudy Conspiracies

In 1981, US President Ronald Reagan shut down the Environmental Protection Agency's

Office of Noise Abatement and Control, effectively rendering the 1972 Noise Control Act

meaningless (Bronzaft 2017, p. 110). Despite an overwhelming archive of documented

physiological harms that follow from extended exposure to noise pollution (Abek 2015; Anees

2017; Bronzaft 2017; Bronzaft and McCarthy 1975; Casey et al. 2017; Correia et al. 2013;

Hansell et al. 2013; Lee et al. 2018; Molina 2021, Stewart et al. 2011), the office has not been

reopened, even as interest grows from discontented constituencies who are rattled by the noise of

everything from airports (Peterson 2021), wind turbines (Bronzaft 2017), to data centers (Bosker

2018). The result is a reframing of noise as "nuisance…a condition…handled by adaptation"

rather than regulation of "noise-making" companies (Bronzaft 2017, p. 110-111). In Chandler,

that "adaptation" takes many forms; residents turn to ear-plugs to get through the night; they use

soundproofing materials on their windows to muffle the incoming hum; they get prescribed

medication for the migraines and insomnia the noise inflicts on their bodies; they pack up and

move away; or, others like Martha "choose" not to hear the hum after becoming cozy with those

responsible for making it. For the most active members of the coalition, however, adaptation

means "making noise" in turn, fighting "fire with fire", as they say.

WordCloud made from simple keyword frequency clusters in interview transcripts with Residents

Their "fight" takes a toll on their health. The wordcloud above, generated by a simple frequency comparison of keyword clusters across a dozen interviews, illustrate the range of mental and physical harms experienced by Chandler residents. The larger descriptors like "headache", "insomnia", "rage", "hum", "fatigue" and "insanity" are shared by more research participants, while the smallest words like "acoustic attack" are more idiosyncratic to a particular individual (in this case, Chandra). While a medical anthropological approach is beyond the scope of my findings and research protocol, these articulations of harm plainly indicate that the Chandler residents I study are experiencing physiological and mental distress. Their actions, pronouncements, and behaviors, I argue, follow from this state of constant agitation to varying degrees. On one end of the spectrum is David Gray, whose noise-induced anxiety has driven him to flirt with suicide as a coping mechanism. On the other, is Martha Haartman, whose outrage and harm can be muted with the flip of the switch, depending on her shifting allegiance to the noise-making data center. Irrespective of their location on this adaptive spectrum (figured below), I frame Chandler residents as medically compromised subjects, situating their actions and discourses as stemming from or influenced by their experiences of harm (Dilger et al. 2018).
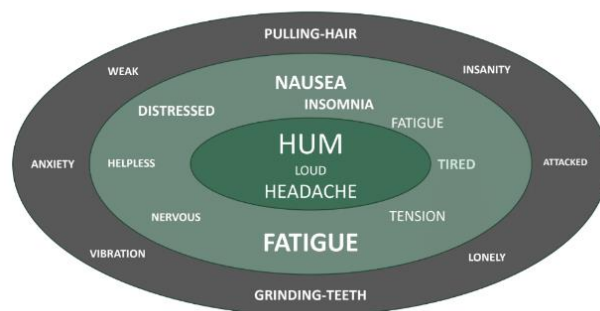
Mapping the distribution of harms in Chandler, Figure by Author

If we assume that many of the Chandler residents I study are operating from a heightened state of distress, the paranoia displayed by individuals like David Gray is to be expected. Their collective state of anxiety, combined with their right-wing political ideology (McIntosh 2021b) and deep sense of injustice over the noise issue, lead them to what Susan Lespelter describes as a "vernacular poetics"(2012) to cope with and explain their sonic circumstances. Chandra's characterization of his experiences to one reporter as "torture" (Sain 2021) or to me as "an acoustic attack", implies a deliberate and nefarious tormentor at work. While Chandra and his neighbors do not dispute CyrusOne and the other data centers in the community as the source of their discontent, they do not confine the blame to the noisy equipment or the data centers' operators and executives, as this social media post illustrates:

CORRUPTION. Lets face it, at this point we have one of two scenarios here. A) Cyrus is paying mega bucks to the city to leave them alone. Or B) The city really doesn't give a crap.

Rather than a failure of the regulatory apparatus, or a callous externalization of digital capitalism's acoustic waste on an unsuspecting populace, the CyrusOne situation is reframed here as the outcome of a vast conspiracy in which compromised city officials are profiting from the ongoing harm of their constituents. This conspiratorial mood extends beyond Chandler. Having learned of my research on a web forum, a resident of Prince William in Virginia's data center alley contacted me to relay her concern for the noise pollution issue in her community, alleging that county officials had been "bought and paid for" by Amazon, which explained their lack of intervention. David Gray, haunted by the tendrils of corruption and specter of concentrated power he associates with Digital Realty, required that I furnish credentials and disclose any financial connections to the data center industry prior to talking to me. Even I was suspected to be part of this ruse.

These accusatory leaps to corruption conspiracies are not entirely unfounded, given the lucrative tax breaks and financial incentives attracting data center companies to Arizona (Bosker 2018) and Virginia (Cook 2017). I argue that these allegations of financial corruption are more than they appear to be. With the demographic of these suburban communities in mind, this diagnosis of corruption extends beyond Chandler City Hall or the corridors of CyrusOne's data center. As I previously argued, noise is a metaphor that exceeds the sonic domain. In an age when far-right elements are fomenting anti-establishment fervor, stoking the flames of institutional distrust with 'alternative facts', and alluding to "sinister, illicit, or conspiratorial dynamics" (McIntosh 2021a) or foul play behind everything from the 2020 election, the COVID-19 pandemic, and the rollout of 5G, there is more to the noise than its frequency or decibels. The noise might be read as what Janet McIntosh calls an "alt-signal" (2021a), a discursive genre that 'plays up conspiracy theories' to 'destabilize expertise and intellectualism', animated by the principal belief that "the white majority are a precariat in decline, imperiled by enemies" that include "minorities, immigrants, the political left" (2021a). For Chandler residents, the "noise" of the data center is also the "noise" of corruption, a world turned upside down, the "noise" of societal fabric woven from white supremacy fraying: Chandler residents, mostly white, call the police only to find that their grievances go ignored. Meanwhile, the "radical left" is shouting #BlackLivesMatter and calling for the abolishment of the carceral state, citing a corrupt and broken criminal justice system that is biased towards whites. Yet their experiences point to contrary. A world upside down, where whites are being phased out, replaced with a multicultural anarchic order typified by the increasing visibility of they/them pronouns. Following this logic, the "noise" of CyrusOne is also the noise of the societal fabric of white supremacy fraying.

Susan Lespelter argues that the American West is the epicenter of the "uncanny" (p.1), a mythic "metadiscourse" that invites conspiracy and fantasy to justify the settler project and alleviate the guilt and conflicted sense of belonging to place that many still carry:

Noticing the weird patterns between various things in everyday life produces anxiety but also a sense of meaning that is never totally explained, a half-dreaded conviction that some undiscovered agency lurks behind the scenes, creating the reiterative pattern. This aspect of the uncanny speaks to what I am calling resonance here: the sense of meaningfulness emerging from parallels and repetitions. (Lespelter 2016, p. 80)

This tendency to find order in disorder, to make meaning out of random convergence or coincidence, what Lespelter describes as apophenia, is exploited by the far-right as they spin narratives of white decline and imminent replacement with disastrous consequences, as the "capitol insurrection" and the 2022 mass-shooting in Buffalo perpetrated by one of its adherents reveal. Followers of QAnon are seduced by the promise of a "subterranean fascistic state-in-waiting" (McIntosh 2021b), encouraged to excavate cryptic codes in the speech patterns and gestures of Trump and other "leaders", in their pursuit of justice for an endangered world order of white supremacy (McIntosh 2022).
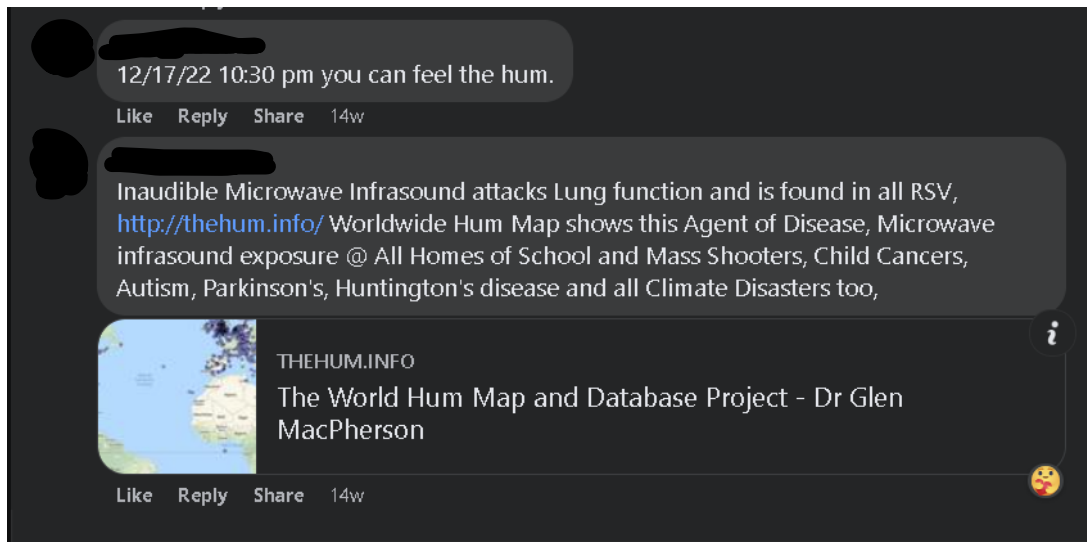
While not overtly steeped in this discourse, Dobson Coalition members search for faraway connections or grand explanations that give greater meaning to their suffering. One commenter offered that the hum of CyrusOne might be part of a larger clustering of noise, which they allege is connected to the rising frequency of certain diseases, climate disasters, and mass shootings, citing the website, "The Hum":

Most people find this website because they are disturbed by an unusual unidentified low-frequency sound that scientists now call the Worldwide Hum. The classic description is that The Hum sounds like a car or truck engine idling outside your home or down the block…The typical characteristics of the World Hum are that sufferers hear it wherever they go, and that other people in the same place and time cannot hear it. This may be a type of **otoacoustic** phenomenon generated internally in the brain and auditory organs, through mechanisms which are not yet fully understood, but for which this project tries to find answers and possible remedies…This is not a place for pseudoscience or conspiracy theories. There are no discussions here regarding so-called "Targeted Individuals" or microwave weapons. There are many other websites and forums for those interested in such things.

In a fascinating irony, the website professes that it is "not a place for pseudoscience or

conspiracy theories", even as the coalition member who posted it attempts to link it to precisely

that, going on to post images of its incident maps, arguing that Arizona is a "supercluster":
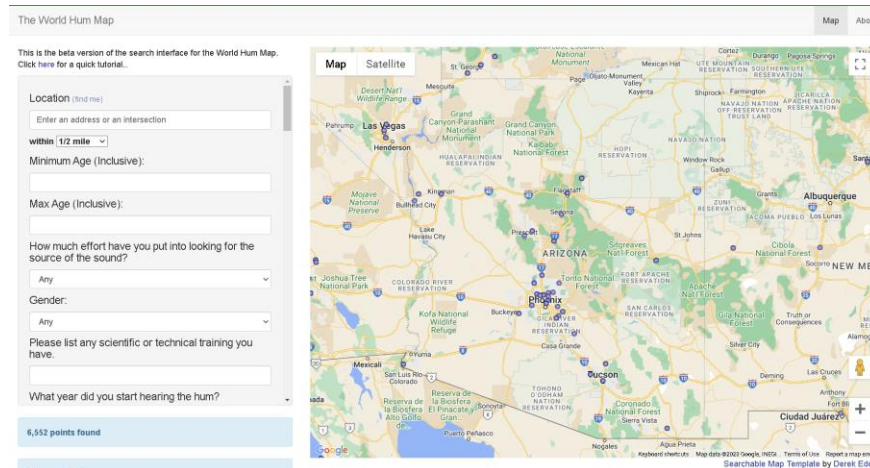
World Hum Map, Screenshot by Author

By inviting others on the forum to view Arizona as an "exceptional" locus for this phenomenon,

citing the infamous Phoenix lights UFO encounter as further proof, the Dobson Coalition

member's behavior mirrors those "abductees" interviewed by Susan Lespelter who she describes

as anxious about their relevance in a swiftly and incomprehensibly changing world (2012).
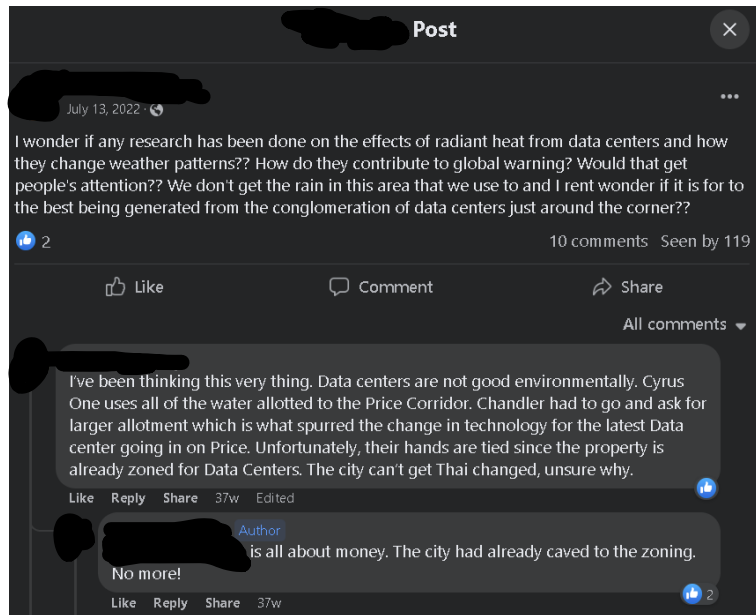
Post about "Radiant Heat", Screenshot by Author

Some instances of this apophenia are far more sophisticated, as the logics they employ

manage the tension inherent in right-wing political ideology that simultaneously value and

dismiss empirical evidence. One noteworthy instance is a post authored by Brenda, where she

ponders if the "radiant heat" from data centers changes "weather patterns" and contributes to

droughts or "global warming". The post, dated to July 13th, is of particular relevance, given the

heatwave that was afflicting the region at that time, with temperatures in excess of 119 degrees

Fahrenheit in the midst of a drought with Lake Mead drained to historic levels. In this instance,

Brenda weighs her empirical observations of heatwaves and droughts to invite a conclusion that

the data center is to blame for "global warming". This is particularly fascinating, given a

previous exchange I had with Brenda, wherein she denied climate change:

Steve: I also research the impact of data centers on other aspects of environment. So water use. Waste. And carbon emissions.

Brenda: So climate change?

Steve: Yeah.

Brenda: You believe in that?

Steve: I do.

Brenda: I think there isn't enough evidence out there to say what is causing the changes we are seeing. Scientists barely understand what's going on in our bodies, let alone the entire world, it's really complicated, you know?

Steve: The greenhouse gas effect is something scientists can verify in laboratories. Venus is a good example.

Brenda: You mean, the planet?

Steve: Yes. It is very volcanic. All those vents and volcanoes spew up gas and make it so much hotter than it should be. I mean, we talk about settling Mars but Venus is much closer. But it's impossible because of those conditions. Think of it this way. Venus is what we could become if we keep emitting greenhouse gasses.

Brenda: That sounds pretty far-fetched.

Steve: I read a lot of science fiction.

Brenda: That's just it, how can you tell the difference?

Per the exchange above, Brenda's post, which occurred nearly a year after this conversation, reflect some evolution on her thinking but importantly, a refusal to buy in to the left-wing narrative of climate change as following from greenhouse gas emissions. In this way, she isn't denying climate change, she is just denying its origin, refusing to use the term, and proposing alternatives that are both empirical and importantly not disruptive of her ideological position. My use of the planet Venus as an example only deepened her stance, as she dismissed the "science fiction" thought experiment I posed as "far-fetched". Brenda activates the views the data center as both a mysterious menace, an example of Lespelter's "uncanny", but also as an explanatory

apparatus for that which she can't explain or won't permit herself to believe. These discursive gymnastics are not incompatible with the wider conspiratorial logics of corruption described earlier, as Brenda's reply in the thread demonstrate, "[it's] all about the money."

Lespelter and other scholars of conspiracy observe that conspiratorial discourses require constant maintenance. Narratives of collusion are subject to revision and amplification as new evidence enters into the community's shared archive or myths. One notable incident occurred shortly after my active fieldwork in the region came to an end. A realtor published an opinion piece for a local newspaper writing off the noise pollution issue as inaccurate, attacking the credibility and motives of coalition members including Chandra. The realtor closes their essay by lamenting that Chandler might "ban" data center expansion in the region, hurting the commercial growth of "new tech development" in the region. They go on to remark for potential real estate developers and buyers that all of their clients "ABSOLUTELY love" living in the greater Phoenix metro area. Coalition members took to the forum to express their solidarity with Chandra and their utter rejection of the "smear campaign" by the real estate agent, who they allege is connected to or supported by the larger conspiracy behind the noise and ongoing expansion of data centers in the region.
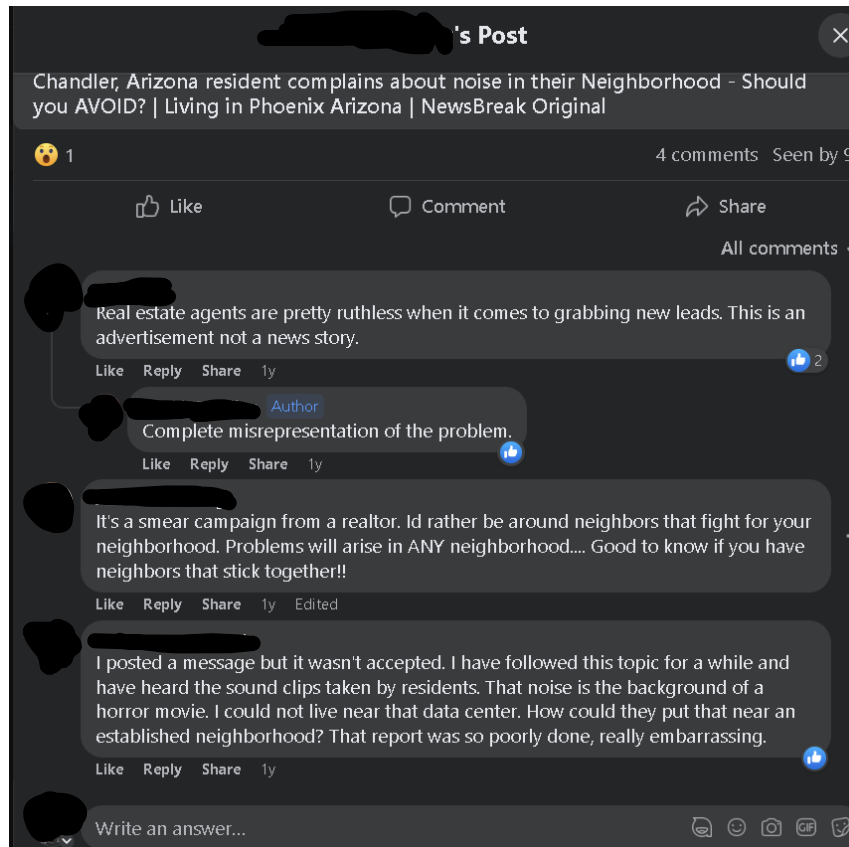
Arline Bronzaft has been making noise about noise pollution for the last forty years (1975). Like Chandra, she has been a somewhat lonely voice of dissent, her scholarship linking poor test scores to noise pollution in the 1970s, and ever since, she has been waging a quiet war against American environmental policy (2017, p. 119). Bronzaft, like the Dobson Noise Coalition, is critical of the national government's refusal to regulate noise-making companies (2017). They both identify regulation as the pathway to restoring peace and quiet to their communities. Companies, however, are not the only noise-making agents, and by comparison, the United States government's imperial engagements have been far louder, and far more destructive to the communities that are its victims.

Peace and Quiet: Unraveling Settler Acoustics

"We are in a vast desert," declared aeronaut James Glaisher to his co-pilot Henry Coxwell, as their balloon crested a puffy mound of cumulus clouds in the troposphere, eleven kilometers above London (McCormack 2018, p. 122). Metaphors like "desert" or French aeronaut Camille Flammarion's "ethereal sea" (Glaisher 1871, McCormack 2018) were invoked by nineteenth century balloonist-explorers to convey the awe they experienced upon glimpsing the world above the clouds. Among the many things that Glaisher and his contemporaries sought to scientifically understand about the atmosphere included temperature, pressure, humidity, its effect on human physiology (he documented his own heart rate), and the properties of sound in high altitudes. "Desert", in this case was not so much a visual metaphor as a sonic one. Glaisher might have imagined the heaps of spooling cloud he was observing as pearly dunes in a heavenly erg, but what conjured the imaginary of the desert for him was the profound lack of resonance at an altitude eight thousand feet higher than mount Everest; the desolation of the clouds, Glaisher discovered *silence*, a soundscape bereft of the "buzzing background noise of the world" (McCormack 2018, p. 123). In the vastness of the firmament there was no audible echo, as if the balloon's proximity to the vacuum of space was already dampening if not muting the reverberance of sound waves.

Camille Flammarion observes a thunderstorm roiling over Fontainebleau. From, "Travels in the Air" (Glaisher 1871).

Empires are noisy affairs. Their expansion is audible as screams or sudden silences, like the archives that tell their stories (Bhowmik 2021; Fowler 2017; Griffin 2021; Moss and Thomas 2021). Glaisher, Coxwell, and Flammarion's aeronautical adventures might be read as notes in the musical score that was Victorian-era "imperialist expansion" (Tucker 1996, p. 165). "Balloomania", however, was never associated with the kind of quiet that Glaisher discovered above the clouds (1996, p. 164). Instead, many, including Charles Dickens regarded the sport as a vulgar affair, where drunken spectators might gather to watch a balloonist burst into flames or fall to their deaths from great heights (1996). The skies were loud with their jeering and laughter even before they became an arena for combat. As the sun waned on the British Empire and waxed on its American successor, the sonosphere irrevocably shifted. With world wars came artificial "thunder" (Chan 2023), as fighter jets and warplanes criss-crossed skies to drop explosive payloads on civilians, military targets, or in the case of the United States, simulated battlegrounds.

On the tiny island of Vieques, part of the archipelago of Puerto Rico, an American colony, the U.S. Navy staged war games, detonating bombs and firing live ammunition to "maintain readiness" (Spencer 2002) for hypothetical German aggression (Chan 2023) or future conquests like the invasion of Baghdad. For sixty years, the clamor of their mock wars rocked the homes of the island's residents who lived within eight miles of active demolitions (Baver 2006; Epting 2015; Herrera-Montes et. al 2010; Maurer 2022). In 2002, the Puerto Rican government wielded what little power it could to strike back, with much protest from defense commentators like Jack Spencer of the Heritage Foundation:

Puerto Rican officials recently filed a lawsuit to stop the Navy from resuming bombing practices on the nearby island of Vieques. Their argument: The drills violate anti-noise laws, including the 1972 federal Noise Control Act…It's a *clever* tactic by the U.S. *territory*, which has been trying to kick the Navy out for years. But this debate is about much more than *peace and quiet* on Vieques…It's about …preserving our ability to keep peace in the world…[Vieques is the] "crown jewel" and…"world standard" of military training areas…[its] size makes it ideal for moving Marines and firing guns from ships and planes without harming *the island's* 9,300 citizens, who live more than *eight miles away* from the bombing area…If the Navy leaves… *Puerto Rican citizens* would lose a valuable *ally* in improving their economic viability. And Americans would lose a training area that assures the quality of our nation's fighting forces…That's a high price -- and it's worth making some noise about.

Spencer exerts extraordinary care in articulating his militant pro-peace position, through a feat of "footwork" in the Goffmanian sense of the term (1979). First, he reminds readers of Puerto Rico's subjugated status by using words like "territory" and "crown jewel" to describe the archipelago. For residents of Vieques exposed to the noise and toxic pollution emitted by the war games (Baver 2006), Spencer makes a point to differentiate them as "the island's" or "Puerto Rico's" citizens – not to be confused with American citizens, implying that they are more

disposable or better candidates for "sacrifice" in the spirit of maintaining US military excellence, and thereby peace (Eting 2015, p. 358). Finally, Spencer deftly weighs the pros and cons, dismissing the need for "peace and quiet" on Vieques as a luxury, which he pitches as insignificant against the grander goal of the total pacificism that follows from American military supremacy. Peace is promised through American martial prowess, which Puerto Ricans stand to benefit from, should they choose to continue to harbor the "valuable ally" that is the U.S. Navy. This logic not only elides the reality that Puerto Ricans serve in the US Navy but the use of a diplomatic term like "ally" also suggests that Puerto Rico and its citizenry are part of a foreign rather than the domestic government. Spencer argues that the accidental murder of Viequese civilian David Sanes was an unfortunate but necessary loss, and indicative of a good track record for safety protocols and risk mitigation in the sixty years of US naval occupation of Vieques. Scholars have since demonstrated a much higher mortality toll if you account for the lingering chemical toxicity and disproportionately rates of health issues for Vieques residents as a result of the naval base and the clamor of its war games in the archipelago (Chan 2023; Herrera-Montes et. al 2010; Maurer 2022).

Submerged in the stunning racism and unapologetic imperialism of Spencer's commentary is a thesis that will be echoed by Chandler residents two decades later: that not all noise pollution is unjust or unnecessary, depending on its nature and who is experiencing it. Spencer dismisses the efforts of Puerto Ricans to put an end to the wargames as a selfish and trivial pursuit of "peace and quiet", not an active attempt to resist an imperial power besieging their people and destroying their ancestral lands. "Quiet" for Vieques comes at the "high cost" of peace for the world, Spencer intimates. "Quiet", in this context, is relegated to the level of

aesthetic preference, not a matter of survival. By extension, Spencer suggests that Puerto Rican

bodies are worth "sacrificing" (Eting 2015, p. 358).

Atticus Miles, a guest commentator on the Dobson Noise Coalition forum, inquired about

the data center noise in Chandler, identifying himself as a resident of southwest Tucson, the site

of the Davis Monthan-Tucson Air Force Base. When Martha asked him if the noise from the

Airforce base was similarly intrusive, he replied that he "can't compare 1 against the other,"

insisting that they are as distinct as "apples and grapefruit." He clarified his remark accordingly:

As for the noise of military aircraft, that is *the sound of freedom*.

In the comment above, Atticus refuses any comparison between the two locations, denying that

the booms of military aircraft above his home are noise, instead framing them as benign "sound",

but not just any "sound", the sound of "*freedom.*" Like Spencer, Atticus makes exceptions for the

clamor of Empires that he won't for the clamor of the Cloud. Those rattled by living near the

airforce base don't warrant sympathy or concern, if anything, they deserve to be derided for their

lack of patriotism and unwillingness to sacrifice themselves in the name of "peace".

A self-proclaimed Trump supporter on social media, Atticus parrots many talking points

of the Republican party, decrying the state of America's "open borders" and its "submissive"

posture in geopolitics. Atticus, a retiree of the armed forces, activates in his posts a performative

genre of "affectively-charged" (McIntosh 2021a) speech co-opted by the far-right from military

personnel (McIntosh 2020), that readily "dehumanizes American service members…who are

semiotically framed as expendable" to shape them into "lethal" weapons by inculcating a "moral

agility" that enables them to kill "the enemy" without remorse or hesitation (McIntosh 2021a, p.

583, p. 588). The recruit is routinely humiliated, reminded of their "abjection" through a litany of

feminizing, infantilizing, racializing, and dehumanizing epithets (2021a, p. 584) aimed at cultivating resilience and hardening their psychological constitution. Janet McIntosh calls this process "semiotic callousing" (2020). In this hypermasculine crucible of war, men are tempered into "necropolitical" machinery (McIntosh 2021a, Hill 2012), withstanding constant verbal insult and mockery, where the deafening volume and grating pitch of the drill sergeant's voice is as much a disciplining agent as the words used to berate and belittle their victims (McIntosh 2020, p. 80). Atticus, possibly reminded of the yells, screams, and shouts, that bruised, scarred and steeled him for service in the Vietnam war, dismisses the notion that the sound of military aircraft are intolerable. Like him, those that live in the proximity of the Air Force Base, must endure the noise inflicted upon them by the US military, sacrificing themselves for the sake of the republic and the peace that it alone can secure. Only then can the noise become audible for them as "the sound of freedom".

Atticus' remark was well-received by many in the coalition, who commented with likes and hearts and thumbs up emojis to signal their approval; the implication being that if CyrusOne were an Airforce base, none of them would be complaining. Just as the skies became a new arena for war, the sonic realm shifted as empire sought to wield it as a weapon. The same bassy tremors of supersonic military aircraft that Atticus dismisses as benign, were weaponized into sonic weaponry by the Israeli military to torment Palestinians in the Gaza strip (Goodman 2012, p. xiii). These sonic booms, destructive blasts created by air pressure wakes carved by supersonic jets, are a "nonlethal" tactic in the increasingly sophisticated armamentarium of modern warfare (p. xiv). This approach targets civilians with deep frequency sound, exploiting vibroacoustic physiology to elicit fear, weaken morale and disorient populations in advance of an attack (72-73). The deeper the frequency, what some scholars call the "unsound" (Goodman et al. 2019;

Jasen 2016) or "infrasound" (Roosth 2018), the stranger and more sinister the effect on the body. Take for instance the "black noise" experiments, which sought to realize sonic weaponry that could "kill enemy combatants by surrounding them in a sonic 'envelope of death' …turning their internal organs into 'jelly'"(2018, p. 112). On the opposite end of the tonal spectrum is the mysterious Havana Syndrome, which sufferers – primarily US diplomats – describe as a "high-pitched, screeching sound" that has resulted in anomalous medical symptoms including brain damage and insomnia (Hsieh 2021).

Sound of any frequency can be transformed into an agent of torture. In concert with other interrogation techniques, US military operatives have discovered that "Beethoven tortures as well as Metallica" (Hill 2012, p. 218). Tormentors inflict loudness and frequency to "ears to coerce compliance by vibrating entire bodies" (p. 218). As in the case of Vieques, noise doubled as a source of physiological harm and an indexical reminder of Puerto Rican colonial subjugation, pitched at muffling any stirrings of revolutionary sentiment over the course of its sixty-year campaign of sonic terror (Chan 2023). Such grisly examples from the history of sonic warfare give new resonance to Chandra's claims of being a victim of an "acoustic attack" or his insistence to a local reporter that what he is experiencing is "torture".

Dobson Coalition members readily slipped into a war footing, urging their comrades to "make some noise" about the noise that was harming their communities, engaging in what Ian E.J. Hill describes as "rhetorical amplification" (2012, p. 223) to resist the weaponization of sound. Such a tactic was also adopted by Vieques activists. Artists turned advocates Guillermo Calzadilla and Jennifer Allora symbolically reclaim the Viequese sonosphere with their 2004

video installation, *Returning as Sound*, which depicts a motorcyclist with a trumpet attached to his exhaust pipe, sounding with a defiant echo of six decades of bombing (Del Barco 2022).

Video installation by Allora and Calzadilla (2004)

A generation later, Puerto Rican music group Cornucopia (Jorge Castro and Claudio Chea) produced the album Vibroacústica:

The title refers to a disease that allegedly afflicts people who have been exposed to loud noise over long periods of time. The vibrations thicken the walls of the heart, so the theory goes, and damage the immune, gastrointestinal, and neurological systems. This is noise as toxin, entering and sickening the body. The album takes the disease as its point of departure, and using location recordings of the coast of Puerto Rico, analog synthetic manipulations and digital processing, both recreates and protests the noise and its impact on human beings in Vieques, Puerto Rico, which was the target of bombing practice for over sixty years. (Bronfman 2021)

Like, *Returning as Sound* before it, *Vibroacústica* challenges the US government's narrative that the atrocities of their naval legacy in Vieques are over with. On the contrary, *Vibroacústica* narrates the ongoing public health reverberations of the Vieques occupation for the communities that persevered over half a century of sonic terror.

In Puerto Rico and Arizona, the refrain, "peace and quiet" unravels upon closer inspection. For Atticus Miles and Jack Spencer, peace is loud. The sound of freedom. The clamor that promises the silencing of a nebulous enemy. Even the quiet is sonorous with reverberations of American imperialism that might not be audible but are still sensible for those that live with the embodied memory of the past's violent din. Sitting across from me at brunch with her pet bird, Martha gestured out to the Sonoran desert, calling it "empty", imagining its quiet desolation as a comfort, like Glaisher above the clouds. Martha's use of the term "empty" implies a volumetric dimension to her sonic experience and imagination, as if she is consciously delving into the oceanic depths where "sounding" emerged as a sort of biomimicry to sonar to image aquatic landscapes and detect for submarines (Helmreich 2009, Helmreich 2015). Martha, like Atticus Miles and Jack Spencer, proposes "dumping" the noise of the Cloud into the imagined vast "emptiness" of the Gila River Indian reservation to reclaim her lost "peace and quiet", as if the residents of the reservation are "sacrificeable" like the Viequeses or the Tucsoners living near the AFB.

Martha's "sonic imaginary' (Sterne 2012) of emptiness is in tension with her love of wildlife (Kilker and Bjelic 2022) and her awareness that the desert surrounding the Estrella mountains is an indigenous reservation. There is a border that sound is settling or unsettling; a rift between a chaotic Wild West past and an orderly modern present; the American Dream and its counterpoint of centuries of indigenous stewardship of supposedly empty lands. As Lisa Sang Mi Min observes in the "uncertain horizon of DMZ borderland" (2020, p. 239) in the interstice between Koreas, sound is "voluminous waves that summon a world beyond the border" (236).

Min frames the echoes from loudspeaker broadcasts in North Korea as "debris portals" that continually reinscribe the uncertain spatial boundaries between the ever-shifting Military Demarcation Line (MDL) and the Civilian Control Zone (CCZ) (234). This process, what Min describes as "echolocation" is always in progress and unfinished as residents, tourists, and military personnel sonically contest where one Korea ends and another begins (234). Martha is not alone in imagining the desert as a more appropriate 'receptacle' to relocate data centers. Others in the coalition variously describe the Sonoran landscape as a natural fit, given its "vacancy", "lack of use", "disrepair", and "solitude", to quote a few of their remarks on my line of questioning. "Disrepair" and "lack of use" appear to be judgments against its indigenous stewards, while "solitude" and "vacancy" seem more like tactical erasures of the region's violent settler history (Stevens 1954).

Janet McIntosh identifies a similar "denial of precolonial stewardship" among white Kenyans commenting on the "ecological sustainability of [Maasai] pastoralists" (2016, p.54). Like the Dobson Coalition members, the wilderness beyond whiteness is imagined by White Kenyans as "tabula rasa" (p. 53) or "empty land" (p. 64), pitched with a careful choreography of settler denial that McIntosh calls "structural oblivion" (p. 82). On the one hand, they stake their claim to belonging by signaling their 'love for the land' (p. 52), and with the other, they deny the theft that brought it to them in the first place. This dynamic of "structural oblivion" is mirrored in interview responses and social media posts from Dobson Coalition members:

I certainly don't want the noise that comes from Cyrus One as *our homes were here long before they* [data centers] *were…*

I love it here. I love Arizona. The birds and the cacti and the landscape is so breathtaking. I can't imagine ever leaving. This is *my* home. *My family's been here for generations.* And now, I might have to leave. This is the evil of this company. Making us *uproot* from the place where we built our families and raised our kids.

I preferred the smell of cow shit in the beginning when I was first got here, when everything was farmland. It was smelly but so much quieter. And I *fell in love* with the place. Breaks my heart, the thought of having to pack it up and leave because of a stupid data center.

We're giving up. Our marriage almost ended because of this noise. We fought over whether or not to stay. *We have the right*. We have rights. This is America – not some third world country. We shouldn't have to pack up and go but that's what we are doing because I love my family more than I love this place.

In the responses above, Chandler residents stake their belonging to the land as ineffable, casting the data center as their displacer, in what strikes me as a perverse co-optation of indigenous land rights claims. Their outrage is predicated on an inalienable "right" to reside in Chandler, with an imagined continuity spanning enough "generations" to consider their displacement an "uprooting". Given the political orientation of many of the residents I interview, it is not surprising that their consumption and engagement with MAGA discourse which is rife with xenophobia against migrants from Latin America, that they are primed to leap to defend white belonging against a besieging Other, especially as right-wing media stokes theories of imminent "white replacement".

A dive into Chandler's settler history suggests another origin for this anxious relationship to the land and their place in it. Originally inhabited by Hohokam peoples, and later by the Pima who irrigated the land to practice agriculture, the area currently known as Chandler remained a vast wilderness into the twentieth century, eluding full settlement even as it shifted hands from

the Spain, to Mexico, to the United States. Below, prospector E.M.T. Powell remarks on the extreme conditions of the terrain and climate:

All our camps are 'dust holes'. We eat dust, drink dust, breathe dust, and sleep in dust! I never was so worn out with dust in my life. It is a serious misery. What this God-forsaken country was made for, I am at a loss to discover. (Powell 1849, Quoted in Stevens 1954)

Regional histories reveal how by the mid-nineteenth century "the area between the Pima Villages along the Gila [river] and the early settlements along the Salt [river] was still uninhabited barren desert" (Stevens 1954, p. 15). Through the last decade of the nineteenth century, the region was one of the last major battlegrounds of the American war with the Apache, thwarting their promise of Manifest Destiny (Huizar- Hernández 2010, p. 6; Stevens 1954, p. 15). Named after its founder, Dr. A.J. Chandler, the town was formally established in 1912, after many failed attempts to establish cattle ranches as a result of drought and poor irrigation systems (1952, p. 20-24, 45). With the establishment of the Consolidated Canal, which refurbished and expanded irrigation systems in nearby Mesa, Chandler came into existence, a cluster of ranches that morphed into a white suburbia refuge by the time of the 2020s.

With this history in mind, Martha's use of the term "empty" to describe the Gila River Indian reservation echoes with Powell's refrains about dust in a "God-forsaken country". A white settler aversion to the desert as a hostile wilderness that refuses to be wholly tamed. So much so that the United States Government instituted a specific law called the "Desert Land Act", awarding land rights to any man anyone who "conducted water upon it" (Stevens 1952, p. 29). For contemporary Chandler residents, the desert beyond the artificial green of their irrigated oasis is a prism for self-reflection; a thing of beauty and wonder; a vacuous receptacle for waste;

a poorly stewarded tract of land by incompetent and inferior human beings; a reminder that Chandler is still "the American West" (Huizar- Hernández 2010). While some might invoke the desert as part of a vast "inhuman sonorous ecology" (Safonov 2019, p. 462), I contend that in this case, the desert is an "echolocation" (Min 2020). It reverberates with past wrongs; the atrocities of the American war with the Apache nation, the "deafening silence of so much death" as Jennifer Stoever says of black sonic erasure (2016). It echoes with failures; the false promise of the American Dream; the unfulfillment of Manifest Destiny; the failure of America to secure its borders from migrants who threaten to "replace" the descendants of settlers who won "their right" to the land. I name this complex of discourses and sonospatial imaginaries, *settler acoustics*.

Sonoran Desert Wilderness, Photo by Author

On a day of rare clouds, I hike the San Tan mountains, gazing north west to search for distant Chandler. There is a sense of peace about this place. Not the kind that Glaisher felt atop the world. For there are many sonorous things here. Birds and buzzing bees and little critters scurrying from rock to rock as I scatter pebbles with my boots. I hear no trace of the data center's hum, but the echo of settler acoustics distorts the xeric beauty of this landscape. I hear it in rock shelters which I suspect were inhabited by Hohokam peoples long before Powell trekked through the "dust holes" that would become Chandler.

[Silence]

Email from CyrusOne sent to customer ID: Dobson Noise Coalition, January 2022
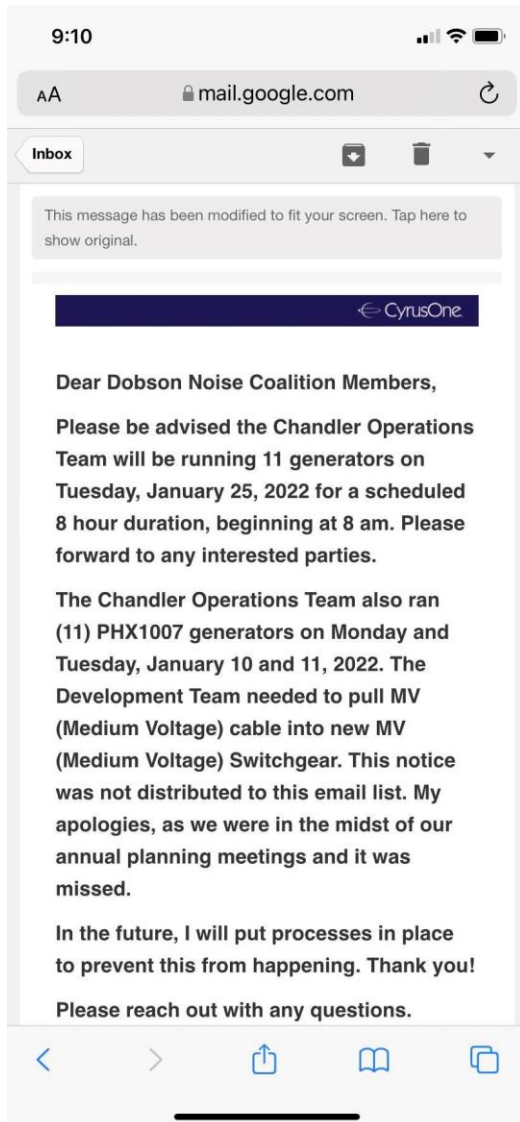
Steve's Archive, "Dobson Noise Coalition Community Posts": January 25th, 2022

Is that the data center I hear humming annoyingly this morning? I'm almost all the way to Alma School and it feels like my house is vibrating.

Steve's Archive, "Dobson Noise Coalition Community Posts": April 2022
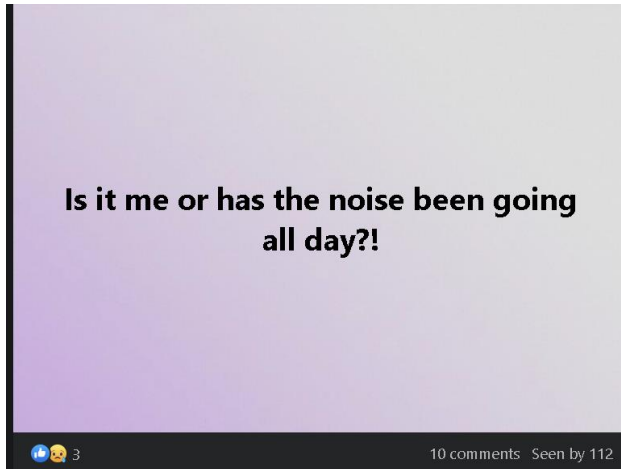
Steve's Archive, "Dobson Noise Coalition Community Posts": September 2022
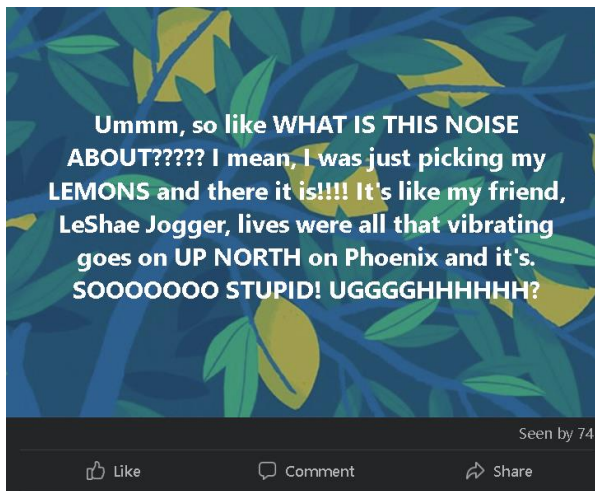
Bulletin posted by City of Chandler, Public Information Officer: January 5th 2023

CHANDLER, Ariz. – The City of Chandler has joined a small list of cities across the nation to adopt a zoning code amendment to define the location and operation of data centers. The approved amendment includes the following provisions:

1. Establishes a new section of the zoning code (Chapter 35, Section 2214) specifically to address data centers

2. Clarifies data centers as a primary use only permitted in planning area development (PAD) zoning designations

3. Clarifies data centers as an ancillary use, including size limitations, purpose, and location on-site

4. Establishes a detailed communications protocol to notify impacted residents about pre- and post-construction, including required neighborhood meetings and an on-site liaison

5. Requires a *pre-construction sound study* to establish noise baseline with results provided to residents prior to a scheduled neighborhood meeting

6. Requires *sound mitigation measures* to ensure noise levels from a data center does not exceed levels observed during baseline study

7. Requires the data center to conduct an *annual noise study during peak operation times* for five years once construction of the data center is complete

8. Establishes backup generator routine maintenance and testing time limitations, including notification protocol

Data centers have evolved throughout the years from single-user facilities to larger multi-tenant facilities and transitioned from water-cooled to electrically-cooled facilities. Due to those changes, there has been an increase in potential noise impacts to the surrounding neighborhoods. Over the years, Chandler has required increased levels of noise study/mitigation efforts, public outreach, and regulations regarding backup power generators.

The ordinance was unanimously approved on Dec. 5, 2022 and took effect on Jan. 5. For more information, contact Chandler's Planning Division staff.

Steve's Archive, "Dobson Noise Coalition Community Posts": January 29th 2023

DobsonNoise Community

Write an answer...

January 28

Thank you Chandler City Council! We appreciate you!

YOURVALLEY.NET
Chandler Council approves data center ordinance
CHANDLER — Arizona municipalities have ordinances to regulate nearly every type of buildin...

You and 9 others   7 comments Seen by 68

👍 Like   💬 Comment   ↪ Share

View more comments

Does not address process to limit existing data center noise and more importantly how to provide for reparations to the people hurt by existing data centers.

Steven's notes: January 5th 2023

Today's news comes as a shock. I never thought I would see this story reach some kind of

resolution point. Even if the ordinance doesn't drastically change their situation, it sets a national

precedent. Their organizing set chain of events in motion that resulted in this. It could have big

implications for future data center construction. No longer is the regulatory environment around

noise "unprecedented." If only I could see the look on that arrogant engineer from CyrusOne's

face…

Brenda: January 5th 2023

Brenda sits out by her pool, throws up her feet on her recliner and sips on her lemonade on this

perfect, cool day. The noise is still there, but she doesn't mind it so much, not today, the day of

Gonzalez Monserrate 143

her well-earned victory. She thought of giving up. So many times she thought it might be better to just give in and sell their home and move back to Flagstaff out where her extended family lives. But that would scar her children, and her pride. So she dug in. She stood her ground. She decided if Chandra could endure five years of fighting, she could endure three. It takes a village to quiet a data center. But in the end, the village always wins.

Chandra: March 2023

Chandra embarks on his evening stroll through Brittany heights, enjoying the sun and the sweet smell of things in bloom. It's still there. Still rumbling behind the beauty of his world. The engine of his torment. An unyielding machine that he has forgotten how to live without. He won't be fooled by the half-measures. He won't settle or compromise until reparations are meted out. Five years of broken promises. Five years of crusading for justice with nothing to show but a zoning ordinance. Five years of mockery and derision from city officials and the community's uppity country club go-ers who would never let an Indian into their vaunted circles, no matter how fancy his car or stacked his bank account was. No. There was no stopping now. Like Ahab scouring the seas, sailing to the ends of the earth in search of a nemesis that he might never catch, here Chandra would remain, to stand between the Cloud and his Chandler. Once there were four. Now…there is only one.

Selena May: May 2023

You did it. You got out. I'm proud of you Selena May. That has a nice ring to it, doesn't it? And the new haircut looks killer on you. You should dye it blue next time, the green blends in too much with the new…neighborhood. If you can even call it that. A cactus forest is a

neighborhood, if you think about it. Cacti are habitats for snakes, little rodents, tarantulas, scorpions, and don't forget those adorable owls and fluffy wrens. They remind you of…you wonder if Archimedes will be happier here in your new cottage, the little haven you bought in the desert with the money you got from selling that dump you used to live in back in Chandler. Back when you were still Martha. Back when all you could hear was…that fucking noise. The noise of your rejection. The noise of your betrayal. The noise of the Cloud loud in your ears every goddamned night and day because you worked from home and could never escape, never run away from its endless thrumming in your ears. It made you want to pull your hair out, so you did. You buzzed it clean off. You became Selena May. Better to become someone new than look back and dwell on your mistakes. They said they forgave you. Chandra looked like he meant it, Brenda didn't. But they were there. They checked in on you when *he* left you high and dry. They were there for you but *you* were already long gone. Silenced by the noise that for so long defined your life. You hate yourself for missing it, for missing them. But it's truly better here in the desert. You were wrong when you told Steve it was empty. You were wrong to think it would be silent. It's not silent – it's screaming! Loud with so much life. You'll be alright, Selena May, you'll be alright.

On May 1ˢᵗ, the woman I refer to as Martha sold her home, changed her identity and relocated to Arizona's southern border with Mexico, not far from a cactus preserve similar to the one she took me to reveal her transgression against the Dobson Noise Coalition. My sincerest hope is that she finds the peace and quiet she has been longing for.

Precipitation: Malinowski's Necroscape

Dear Dr. Malinowski,

Today is the day we crossed the threshold. 650,000 deaths and counting. This not-so-Chinese Coronavirus is more virulent than your unSpanish Influenza.

Instead of a boat, it is a plane that waits for me. The plane bound for the field. Except a different one. Not the one I spent three years arranging. No, a field that is at once home and isn't. A far cry from your imperial misadventure in the Trobriands. Here I am at once insider and outsider, an emic-etic hybrid, child of the Boricua diaspora, raised in the mainland, an American interloper. While COVID rages, I venture out to sea, to the Caribbean tide that calls me home. I bring the Empire's shadow with me, as I land in San Juan, as I quarantine in old buildings built by the Spaniards who enslaved and raped and decimated the Taino and the Yorubans they plundered from African shores to replace them. From this mélange of violence, in a genetic maelstrom of three continents, I spawn, a rape-child of colonizers and those they colonized. I am imperial debris, trauma enfleshed. And yet after Indigenous genocide, Slavery, Spanish and American rule, Bankruptcy, Hurricane Maria, Earthquakes, and COVID-19 we/they still exist even without paper towels from tyrants to clean up the backsplash from wave after wave of disaster. They/We are on our own. Unlike you, I go to an island that some part of me recognizes as home. I go to learn, not to become Native, but to remember what Native means (to me/they) and for whom. However, like Malinowski, I am a harbinger of death. My body is a vessel for an invisible ailment. To attempt this project that Malinowski boldly proclaimed as fieldwork, I must risk their lives, the lives of my people, lives already so vulnerable and decimated. I do not wish to bring death, I do not wish to walk among the wreckage, the bodies that this *un*fluenza has claimed. But I do anyway. Because I must. Because this ethnography is my kula ring, the token that I must circulate to define my career, my character, my nature, and my value as an Anthropologist in the first quarter of the twenty-first century. It would seem then, that this necroscape I find myself in, the one I fear bringing about, is of your design. Because your legacy was to create something called "fieldwork". If things go badly, I might see you there, on the other side.

Until soon (but hopefully not too soon),

September 7th, 2020

Steven Gonzalez Monserrate,

Anthropological Neophyte

III - Cloud Hydraulics

Sweating Servers

The Arizona sun tinges my sweat-soaked forehead as I venture out into the courtyard of an urban data center campus, accompanied by Martin, a fifty something year old technician who seems unphased by the 118°F/47°C heatwave scorching the greater Phoenix metro area. We approach a fleet of what appear to be shipping containers, crisscrossing a walled-off courtyard where a cat is darting around, searching for some shade.

"G703," Martin says, pointing to one of them. I notice bundles of sheathed cabling running along the perimeter of the containers. What appear to be ingress and egress pipes are attached to panels at the rear of the structures, color-coded in blue and yellow, respectively. As we approach, I notice mirky water sluicing through narrow channels carved into the concrete. This canal is fed by the faintly humming containers, their liquid waste converging in brown tributaries as they run toward unseen drains.
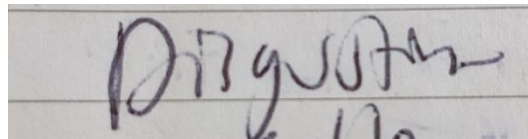
Photograph of field notebook, By Author

"Brace yourself," Martin warns me, as he swipes his ID card to unlock the container door, "this place is *disgusting*." I am struck by his characterization of the modular server room as *disgusting*. I messily jot it down in my field notebook as I enter. Martin instructs me to seal the door quickly, to prevent the air from "venting out". That's when I smell it. A chlorinated, mildewy brume wafting about the enclosed space, which is filled on one side with glittering

servers and the other, with what resemble slabs of wafery packaging foam. They are the source

of the foul mist spewing toward us. Upon closer inspection, I notice the honeycomb shaped

"filter media" (as they are called), are oozing with dirt and other particulates from the Colorado

River. I had learned of this adiabatic cooling system from Gabriel, the data center's Facility

Manager in a previous visit, in the cool comfort of the office building's air conditioned and

brightly colored conference room.

Martin uses a handkerchief to wipe the film of perspiration forming over his brow, his

sweat indistinguishable from the moisture glistening on the pores of the filter media. He gestures

to the servers blinking behind us, "you see, they sweat just like we do."

Artistic Rendering of Filter Media in Adiabatic Cooling System, Image by Author

I read Martin's comment as not only didactic from a technical standpoint, but also illustrative of

a larger metabolic complex at work in the imaginaries and language of technicians who maintain

data centers. The waffly filter media, like our skin, cool rapidly as the artificially induced

perspiration evaporates, drawing heat away with it. Like our own bodies, this thermodynamic

adaptation works most efficiently in climates where the ambient humidity is low. This is one of

many reasons that data centers are flocking to the southwestern United States; the companies that

run them seek to exploit desert aridity to cool servers with less energy, boosting the metrics they use to extoll their "green" image amid the climate crisis (Starosielski 2021, p. 216).

Unlike the "dry heat" outside, the marginally cooler conditions within the container feel worse rather than better, due to the escaped moisture thickening in unseen clouds above our heads, ultimately condensing into tiny drains that feed the canals I spotted on my way inside. This box in the desert feels like a sauna.

"I see what you mean," I manage to say, "this is pretty unbearable."

Martin chuckles, pats a damp hand on my shoulder and gestures to the filter media, which apparently needs to be replaced. "You get used to it."

He hands me pliers to unclamp the sheets on either end, and then we hoist the heavily-soaked foam material from its sheath. My fingers recoil from its sliminess. Martin notices with a snicker, much to my embarrassment.

"That's all the sediment from the water supply. And you know bacteria like to grow where it's wet and hot ." His index finger hovers over the brownish sludge caked between the honeycomb grooves, "this is why we call this place *The Mouth*."

"The Mouth", An Artistic Rendering by Author

In my experience shadowing data center technicians in Arizona and elsewhere throughout the United States, I have encountered a rich animistic lexicon that technicians use to describe the servers, air conditioners, and IT equipment they spend their days tending to:

Behavioral	Context/Meaning	Referent
Fussy	Prone to software errors; requires regular maintenance	Server
Moody	Prone to software errors; overheats easily	Server
Bitchy	Shuts down unexpectedly; difficult to install or remove	Server
Whiny	On-board fans are particularly loud; overheats easily	Server
Solid	Requires little oversight; resilient to changes in conditions	Server

Metabolic	Context/Meaning	Referent
Hungry	High energy requirements	Server or Rack of Servers

Sweaty	Reliant on evaporative cooling; overheats easily	Server or Rack of Servers
Tired	Insufficient compute power; High IT load	Server or Rack of Servers
Geriatric	Nearing End-of-Life; Expired Warranty	Server
Obese	Heavy; Difficult to lift or install	Server

Nominative	Context/Meaning	Referent
Old Mare	Aging but reliable; Earned name after weathering a power surge without issue	Server
Hoth	Malfunctioning; tends to overcool the rack or room; Named after ice planet in Star Wars	Computer Room Air Conditioner (CRAC)
NutCRACker	Extremely heavy; difficult to lift; a pun on the aphorism; "ball buster"	Computer Room Air Conditioner (CRAC)
The Mouth	Hot; wet; dark; fetid; enclosed; 'consumptive' of energy and water	Modular Data Center with Adiabatic Cooling Unit

Martin's sobriquet for G307, "The Mouth", is consistent with the emic tendency (sketched above) to frame machines as more-than-human agents with behaviors, personalities, and metabolisms (Pike 1967). In the 1980s, Julian Orr observed a similar phenomenon with photocopiers and the men who repaired them:

"Just as sheep in a flock are individuals to their shepherd, so do specific machines appear in technicians' discourse as individuals with histories and known propensities for perverse or benign behavior" (1990, p. 89)

Like the men who appear in Orr's ethnography, *Talking About Machines* (1990), the technicians I observe in data centers treat machines as if they are individuals, narrating the dramas of their short lives by the coffee machine or while we are tidying the cables that coil up from the racks

into tightly bundled coils that run along the ceiling like multicolored snakes. Embedded in these biographies of "things", are tales of triumphant repair and technical heroics, that valorize above all else, the work of technicians like Martin who maintain "digital civilization", as he once put it.[4]

One such machine is "Old Mare", a notably feminized blade server that has trucked along well beyond "her" warranty date, with special permissions and a liability waiver signed by the thrifty client it serves somewhere in the greater Phoenix metro area. "Old Mare" is what Martin and his trainee Elliot call a "geriatric" server. These servers are at or beyond "the end of their lives", with many of their internal components so obsolete that their computational utility is limited to maintaining a simple website or backing up a database. Nonetheless, "Old Mare" earned "her" name after weathering a power surge that shorted most of the equipment on the rack where "she" was hosted.

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[4] I describe some of the gendered dynamics of the data center workplace at length in my chapter, "Cloud Energetics".

We list the top 10 data centres built underground from companies such as Iron Mountain, Bluebird, and Subtropolis, which also is the most secure

Iron Mountain WPA-1 facility in Western Pennsylvania, Image: Screenshot, Data Centre Journal

"The Mouth", however, is less a descriptor of an individual personality and more of a phenomenal echo that might be traced back to the subterranean. This leap into the abyss of speleology is not so jarring if we consider the tendency to house data centers in defunct military bunkers, salt mines, and even caves (Hu 2015, p. 96-97; Taylor 2021). For example, Iron Mountain's WPA-1 facility, built inside a cavern in Western Pennsylvania, harnesses its underground Lake to efficiently cool its servers (Steers 2022). This might be an example of what Donna Haraway calls a "tentacular" relationality, a Cloud that is more "chthonic" than ethereal (2016); an "infrastructuring" of deep earth rather than "arctic air" to stabilize data flows in a warming world (Vonderau 2019).

Carved from porous limestone in the Black Hills of South Dakota, is what the Lakota refer to Maka Oniye or "breathing earth" (Rossi 2017). The U.S. Department of Interior has named it Wind Cave National Park, a nod to the Lakota designation but also a reference to the unusual phenomenon that occurs within its labyrinthine expanse; subtle shifts in barometric pressure cycle air in and out of the cave's entrance, resulting in palpable 'exhalations' of air

(Knierim 2019). Like Martin's modular data center, caves "breathe". Their entrances, often referred to as "mouths" in speleological accounts, trap moisture in a manner similar to G703. Most caverns are the result of hydraulic activity; water seeping through cracks and fissures in the earth, carving tunnels and pockets, hollowing out bedrock from within over the course of many millennia (Ballestero 2019; Douglas 2000, p. 20; Gillieson 2021). Insulated from exterior weather conditions, caves have been historically utilized by humans as refuges from extremes heat as well as cold (Hobart 2023; Hobbs III 2017; Rex 2019). From the Pleistocene to the Anthropocene (Fewkes 1910), the oft-repeated phrase "cool as a cave" (Starosielski 2021, p. 89), might be used to sum up the environmental history of cave use in the scorching desert landscape of what is today known as the American southwest (Abbott 2006, p. 20; Douglas 2000, p. 42, 47, 51, 55).

Long before the advent of air conditioning, the darkness and coolness of underground cellars served as natural refrigerators for perishable foodstuffs (Douglas 2000, p. 85). In the sweltering heat of August in 1797, Francis Bailey, an Englishman trekking through the Tennessee wilderness, remarked on the suitability of a cave as a heat shelter:

Not far from the road, is a very great natural curiosity. It is a subterraneous cavity in a rock under the mountains, down which you descend, by some steps cut in the stone, into a large spacious room, through which runs a clear, limpid stream of spring water, which rises from the rock at one end, and flows out the other, through a passage under ground, and disgorges itself in the open air, not far from the entrance to the cave. I thought within myself, that this would form an admirable situation for a settlement, and this subterraneous cavity would afford an excellent convenience for a spring house, being always cool, even in the hottest season (Douglas 2000, p. 84, quoted from Williams 1928)

Bailey's novel idea turned out to be a standard practice of the indigenous communities that had resided in the region prior to the arrival of settlers, having "cut" the stone steps to create the

thermal sanctuary that Bailey discovered (p. 85). This account is one of many that suggest that the history of air conditioning can be traced back to caves as cooling infrastructures (p. 147, 155).

Perhaps the earliest attempt to transform caves into air conditioners is M.H. Crump's 1886 proposal to harness Grand Avenue Cave in Kentucky to construct a "cool-air summer resort":

Grand Avenue cave, situated four miles from Mammoth cave, contains some nine miles of avenues filled with delightfully cool, pure, dry air; temperature 55'. I propose to erect a house immediately over this cave; make the outside walls and partitions all hollow…which shall be connected with the cave by a large shaft… The question is, will the air between the house and cave take the temperature of the cave by diffusion or otherwise, or will it be necessary to use mechanical means to get the air into the building? I have seen and spoken to several scientific men on the subject, who agree with me that an interchange of air will take place and continue until equilibrium is restored by making the temperatures the same. It is proposed to erect a hotel for a cool-air summer resort, and also for a sanitarium. (Crump 1886)

Crump's entrepreneurial enthusiasm is somewhat tempered by an epistemological uncertainty; was artificial climate control even possible? At the time of Crump's writing, air conditioning technology was still in its infancy, more the stuff of fantasy than technical possibility, which Rosalind Williams traces to fanciful microclimates depicted in early science fiction submersibles, dirigibles, and worlds beyond Earth (2013).
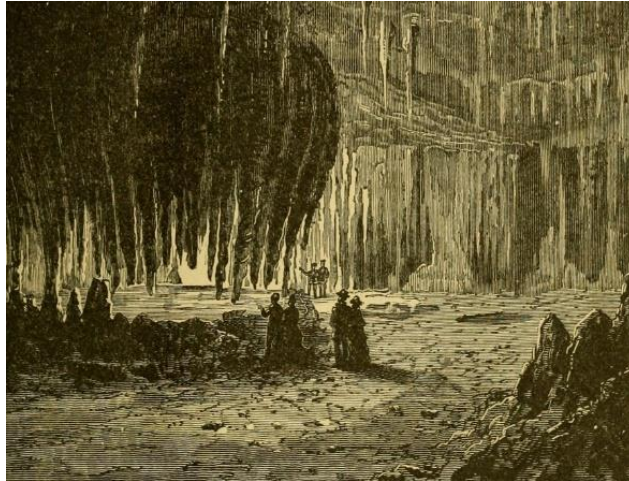
Image: Luray Cavern, c. 1881.

In the nearby Shenandoah Valley, Crump's idea to transform a cave into a natural air conditioner was brought to fruition by the architects of the Limair Sanitarium. There, air venting up from Luray Caverns was harnessed to provide cooling to patients and visitors. Guy L. Hunner, a scientist who sought to understand the mechanisms behind the Sanitarium's success, relayed his findings to Popular Science Magazine in 1904:

In spite of the bacteriologic purity of the air in Limair Sanitarium, I am sure many will protest against breathing the polluted, moldy emanations from a source never penetrated by the rays of the sun. I must confess this was my first impression, and the same prejudice has been expressed by many friends with whom I have conversed. But what are the facts, and what is the condition of the caverns' air? In the first place the air is not stagnant. In any part of the caverns the guide's candle, if placed on the floor or on the ledge of a wall, shows by the deflected flame a very decided current of air. Owing to the differences in temperature, there is a constant interchange of air between the caverns and the outside world. This circulation takes place through many natural filters distributed over the hillside in the form of crevices in the rock, which have become filled by porous soil. Both air and water are cleansed in passing through these earth filters. If there be any open fissures for the admission of unfiltered air, its organic particles would soon be deposited on the damp caverns' walls. The action of water passing over and causing the slow dissolution of such a vast surface of limestone cannot but be beneficial to the caverns' air. It would be trite to dwell

on the advantages of lime as a purifier and disinfectant…Can we arrive at any other conclusion than that here we have the purest and cleanest *atmosphere* that can anywhere be found? (562-563, emphasis mine)

Hunner goes on to laud this discovery and its future application in "hospitals and large public conditions" (564). In this age of tuberculosis, healing properties were ascribed to airs of various qualities, leading to "cave tourism" (Douglas 2000, p. 11) and the creation of sanitariums like Limair to treat patients afflicted with "bad air" (Vale 2022). These epidemiological ideas can be traced back to the writings of Hippocrates. In *On Breaths*, the philosopher theorizes that disease afflicts the body when there are "disruptions in the flow" of inner breath and outer winds (Kuriyama 1999, p. 246). Miasma, a disease etiology based on atmospheric conditions and "humors", held into the early twentieth century in Europe and the United States, before it was supplanted by germ theory (Murphy 2000, p. 23). Hunner, a scientist, was influenced by the latter etiology. The underlying marvel of Luray Caverns, for Hunner, was their ability to produce consistently cool and moist air free from pathogens. The hermetically sealed "atmosphere" (1904, p.563) in caves attracted Hunner's curiosity; in a word, the cave was a "natural laboratory" (Paulson and White 1964) that could yield experimental insights. Hunner hoped this thermally balanced, sterile microclimate found in Luray Caverns could be reverse-engineered and reproduced mechanically in the design of public spaces, transforming the stuff of science fiction into reality (1904, p. 564).

Showing Flag beneath the Ceiling carried out Horizontally by the Inflow of
Cavern Air. Also the flame of the candle deflected by the outflow of air
from the bedroom.
POPULAR SCIENCE MONTHLY

Image: Popular Science Monthly (1904)

Until the early twentieth century, "ventilation [for Americans] was simply opening windows" (Murphy 2000, p. 23). The Luray Caverns were exceptional because they appeared to operate independently of the macroclimate that overdetermined thermal experience in Hunner's era; they were a proof of concept for artificial climate futures. "Manmade weather" (Cooper 1998, p. 8; Furuhata 2022, p. 52), as it was called at the turn of the twentieth century, for many promised an age when windows could be 'indefinitely shut', through the "mechanical reproduction" of 'good weather' indoors (Cooper 1998, p. 1). Air conditioning was not only about thermal regulation or humidity control but the discrete separation of indoors and outdoors, hence the use of the term "weather". Heretofore, "weather" was a thing of Nature that acted upon humans, not something that humans could create themselves (Cooper 1998, p. 2). Like the cat I spotted scurrying about the modular data center in search of shade, the mode of thermoregulation in the nineteenth century was *adaptation* rather than *control*.

In America, "indoor climate" control (Murphy 2000, p. 19) first appeared in industrial spaces, rather than homes. Nicole Starosielski locates the origin of "media's coldward course"

(2021, p. 197) to the print industry and its pursuit of standardization. Early printers had to contend with the dual challenge of variable weather conditions and the runaway mechanical heat generated by their presses:

Attempts were made to address…this [thermal] problem by manufacturing paper with a lower sensitivity to temperature and humidity, but ultimately the solution adopted was environmental control—and particularly the convective medium of air-conditioning. According to its well-rehearsed origin story, the father of air-conditioning, Willis Carrier, was invited to the Brooklyn printing company Sackett and Wilhelms in 1902. At the time, the company was dealing with the typical problems of color printing: as ink was applied one layer at a time, images were misaligned when the paper stock expanded and contracted, causing delays in the production schedule, producing a massive amount of waste, and resulting in poor quality…Carrier designed an air-conditioning system to regulate temperature and humidity in the plant, improving the reproduction of color images in *Judge* magazine, one of Sackett and Wilhelms's most important clients. As it was deployed across printing plants, air-conditioning facilitated the standardization and precise replication of paper-based media. In turn, it linked the expansion of color printing to a regime of thermopower, tethering the standardized image to an infrastructure of temperature control. (199)

Gail Cooper identifies "dehumidification" (1998, p. 57) as the secret behind Willis Carrier's early successes with air conditioning. This early "manmade weather" was about the "mechanized control of condensed vapor" (Furuhata 2022, p. 52) rather than the direct control of temperature. Carrier went on to market his mechanical simulacrum of the Limair Sanitarium to a range of industries where thermoregulation proved to be vital for product quality. In the 1910s, Carrier's air conditioners were used to "eliminate the white specks that formed on film at the Celluloid Company" enabling the motion picture industry through to move from the Mid-Atlantic cool of "Fort Lee" to the heat of "Hollywood" (Starosielski 2021, p. 200-201). Carrier's "man-made weather" machines ended the tyranny of the macroclimate on industry.
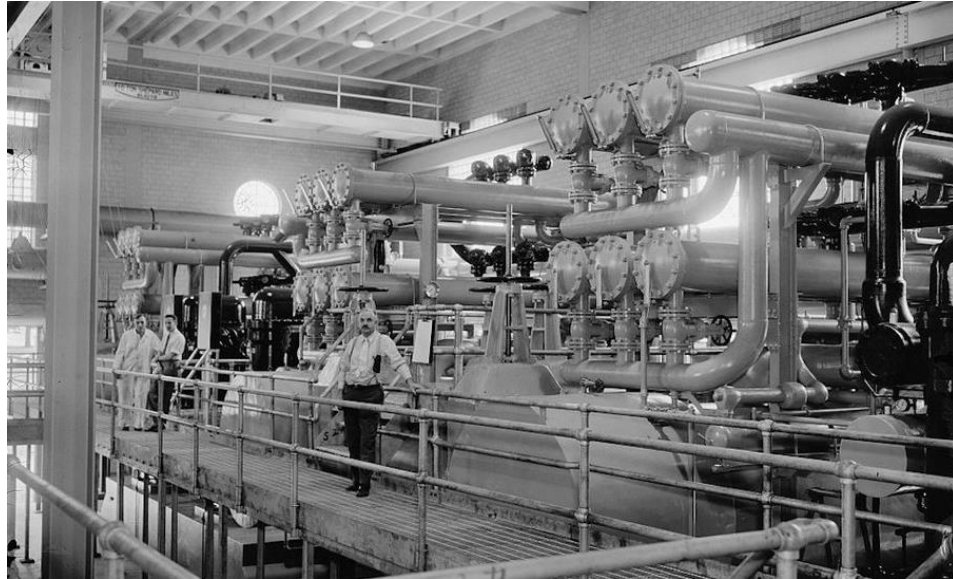
Willis Carrier with his Air Conditioning System, 1938; Image: Library of Congress

Air conditioning proved to be particularly valuable for print and film media, enabling the development of standards for outputs that had never before been possible. The history of refrigeration reveals how cooling enabled temporal compression and imperial cohesion (Hobart 2023). Cold slows things down, enabling preservation, stabilizing unruly materialities just short of melting (Radin and Kowal 2017). For early twentieth century architects and the companies that employed them, human beings were among the materialities to be considered in the design of office buildings. They theorized that cooler humans might be more efficient than sweaty ones. This led to shifts in design ideology that embraced the total bifurcation of 'inside' and 'outside' (Thompson 2004), fulfilling the desire for a world where windows could be "indefinitely shut" (Cooper 1998, p. 1).

Advertisements in this era "compared…[these] sealed buildings to the automated space capsules promised for the near future, with their life-supporting artificial environments" (Murphy 2000, p. 28). The "weather-making buildings" of this era projected an image of a "technocratic future" (28) "sealed off from both the polluted outdoors" (19). These "clean" and "orderly"

hermetic enclosures were designed to "encourage the buzz of information work inside" (19), their designs and architectures optimized for human labor, an assemblage that Michelle Murphy calls "man-in-a-box" (p. 34):

"Like other interwar researchers calibrating the efficiency of the laboring body, engineers studied the skin-sealed human motor as they did other machines, by measuring inputs and outputs…the artificial climate made within the environmental chamber was the input. The output was comfortable and productive labor as indicated by such physiological measurements as those of pulse, weight loss, 'metabolism' (exhaled breath), and body temperature…Distanced from medical concerns, the body that ventilation engineers investigated was one of skin effects, sweat, and other sensations associated with comfort. 'Comfort' was materialized as a neutral atmosphere that least exerted itself on bodies in business dress. All bodies, no matter how different, strove toward the same ideal of efficiency. Comfort could be universalized. This shared possibility of fleshly comfort, moreover, could be located as a quantifiable combination of just three qualities: temperature, humidity, and airflow. The assemblage of comfortable human-machine in a box-machine generated combinations of temperature, humidity, and airflow that were then distilled into a statistical representational form, the ''comfort zone chart'' that could then be built everywhere for everybody. In short, bodies governed by nature's norms could be translated into a universalizable environment" (25).

In data centers, hu(man) and machine 'comfort' are intertwined. G703 is very much Murphy's "man-in-a-box", down to its universalization of the masculine body (2000, p. 34) and the audible "buzz" of the "information work" within its walls (p. 19) Where it diverges from these early twentieth century workplaces, however, is its prioritization of the 'metabolism' (p. 25) of the computers, who more than the humans, are responsible for maintaining "digital civilization", to borrow Martin's dramatic framing.

G703, the modular data center that Martin has named "The Mouth", is not like a typical data center, in that its internal climate is on the edge of unsuitably for the humans that work within it. In the primary data center campus, a place of glittering server racks neatly arrayed in

pristine, white halls, the average temperature hovers within a few degrees of 20°C /68°F and its relative humidity kept between 40-50%. It is nothing like the "sauna", I experienced in G703. In an effort to increase the energy efficiency of data centers and minimize their contribution to climate change, ASHRAE, or the American Society of Heating, Refrigerating and Air-Conditioning Engineers, has shifted their data center operating guidelines with higher temperature and humidity thresholds; as high as 27°C / 81°F and 80%, respectively (ASHRAE 2023). Few but the highest tier data centers can actually maintain their equipment in such extreme conditions. For multi-tenant facilities like the one that contains "the Mouth", client contracts or "service level agreements" (SLAs) provision specific environmental conditions and maintenance requirements. For many clients, the idea of "sweatier" data centers comes with too great a risk for comfort. The cost of a thermal outage is too great even if the operational costs are lower. As Jeffrey Moro puts it, "the true threat [for data centers] comes from within, not without, as unchecked servers…[might] heat themselves to oblivion" (Moro 2021, p. 8).

While the days of "seeing your breath" and "wearing a parka and gloves in the data center" are largely over, Martin tells me, referring to the early era of "flood cooling" practices in the data centers of the 2000s, most data centers today aren't as sweaty as "The Mouth". Reporting from the "windowless bowels" of an Equinix data center in northern Virginia, Jeffrey Moro describes his encounter with an "ominously neutral sort of temperature" that is wielded to forestall but not prevent "the total heat death that awaits all data" (2021, p. 2). Data centers are fashioned into "climate bunkers" (2021, p. 3), replicating the thermal and hydraulic "equilibrium" of places like the Luray caverns (Hunner 1904), to abate the "constant thermal crisis" inherent to digital computation (Moro 2021, p. 8). As artificial caves of a sort, data centers like Iron Mountain's WPA-1 subterranean facility harness nature as cooling

infrastructure (Carse 2012; Hu 2015), "hardware" for its "software" (Hogan 2018). For data

centers closer to the clouds, like "The Mouth", "atmospheric" (Moro 2022) rather than abyssal

affordances are hijacked to facilitate computational chill (Furuhata 2022, p. 25), to create

"natural homes" (Johnson 2019) for data. Big Tech has "suborned" Earth's climate to serve as "a

passive HVAC system" (Moro 2021, p. 3) to cool its digital 'factories' (Ensmenger 2021),

harnessing the cold of the Arctic (Johnson 2023; Hogan 2018; Upham et al. 2022; Vonderau

2019), the Antarctic (Gallagher 2012), recycled alpine snow (Furuhata 2022, p. 25-26), the deep

sea (Sutherland and Bopp 2023) and outer space (Au 2022); but also, as "the Mouth" reveals, the

aridity of the world's deserts (Lehuedé 2022) as a resource for more efficiently cooling

computers.

White Data Center in Bibai Japan, Screenshot by Author, Source: Data Center Dynamics

In G703, where "man-in-a-box" (Murphy 2000) and "machine-in-a-box" cohere as one

perspiring cyborgian assemblage not unlike Stefan Helmreich's oceanographic submersible *Alvin*

(2007), the boundary between human and machine "sweat" is blurry. In the filter media that line

one end of the more-than-human capsule G703, salts liberated by evaporation from human bodies like mine and Martin's combine with the reclaimed sediments from the Colorado river misted onto the honeycomb filter media. In the ooze that proliferates from this more-than-human mingling, colonies of microbes flourish. Life spun from clouds. An entire ecosystem "emerges", nourished by digital ecologies and the tedious labor that keeps bits hurtling through undersea tubes at lightspeed from server to user (Kirksey 2015). Martin's contention that his repair of digital infrastructure is what maintains "civilization", takes on a new meaning, if we take a less anthropocentric view.

My hand recoiled upon touching the slime coating the filter media. Some part of me was "disgusted" by the liveliness of this human-computer collaboration, manifest in the ashen sludge smudged about the cavities of the filter media, and later, the cuticles along my fingernails. I recall washing my hands extensively in the men's room during my lunch break a few hours later, wondering if I had been contaminated. Later, after my shift, I reflected on my behavior in a voice memo:

I worked in that enclosed space with [name redacted] for over an hour. You would think I would be more concerned about a COVID-19 exposure than a bacterial infection from whatever was in that goop…I have three more test kits – will use one on Friday – which is three days from the exposure if I was exposed…That container is an epidemiological nightmare. The smell was terrible. Like a musky gym that hasn't been cleaned in a long time, but also a pool somehow? Very chlorinated. Note: ask about chemicals they use to treat the water or do they filter it with RO [reverse osmosis]? If there were such a thing as "Sick Server Syndrome", G703 would be patient zero. (June 2021)

Above, I joke about "Sick Server Syndrome", my mind acutely tuned to the everyday epidemiological risks of "human subjects research" in the midst of a pandemic, just two months into the rollout of vaccines in the United States. While the circumstances of COVID-19 were

novel, data center designs and practices had already anticipated the risks that pathogens might

pose to the functioning of servers and their human maintainers.

View from Office Building, Phoenix Metro Area, Image: Author

When I first arrived at the urban data center campus to begin fieldwork, I was greeted by

Gabriel, a clean-cut executive with a crisp, pressed shirt, and a number of lanyards dangling from

his neck. He ushered me through a gauntlet of security checkpoints; I presented two forms of

identification at the front desk; verified my identity with a biometric camera; walked through a

metal detector and submitted my personal electronics to a bin for the duration of my tour. With

Gabriel leading the way, swiping his ID card, I walked through three layers of "mantraps"

(Taylor 2021, p. 83), one-way access rooms that automatically lock when shut, requiring a valid

ID to proceed form one chamber to the next. These security measures were consistent with other

data centers that I had visited, many of them more about projecting an 'image' of safety (Taylor

2021; 2023) to clients than actually keeping would-be vandals at bay. Having encountered

similar measures in data centers as an ethnographer, A.R.E. Taylor, describes technologies like

biometric scanners (2021, p. 80) as "security performances", which are part of a larger "visual politics" (p. 78) of vigilance which include everything from color to the siting of data centers in abandoned bunkers for added defensive cachet. Jeffrey Moro remarks on the irony of this securitization of the digital sphere, having visited an Equinix facility (DC11) in Virginia's data center alley:

Despite its role as a waystation on the information superhighway, DC11 is impregnable, a bunker through which only data and air may flow (2021, p. 11)

Like Taylor, Moro characterizes data centers as "bunkers" (2021), emphasizing their impermeability to all but "computation traffic" (Velkova 2016) and air (Moro 2022; Taylor 2023; Vonderau 2019). Despite their best efforts to the contrary, the data center is constantly besieged by another, less visible intruder.
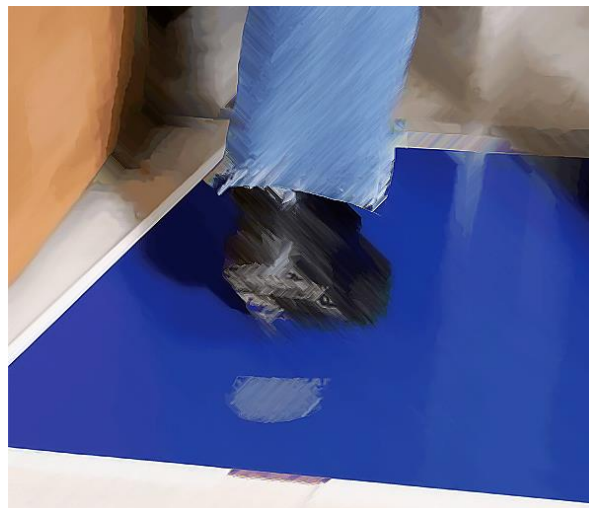
Contamination Mat, Artistic Rendering by Author

Once inside, Gabriel escorts me into an elevator, where we begin our ascent to the floor where the server racks and air conditioning units are kept. The bell chimes as the elevator door

swings open. I lift my foot to step outside, but Gabriel audible grumble makes me stop. He tilts

his head to the floor, drawing my attention to a shiny blue mat just beyond the threshold of the

elevator door. I follow his lead, stepping on the mat, which I realize is composed of a very sticky

gel. For a moment, I feel like a mouse caught in a trap, but with a little effort, I am able pull my

feet from its adhesive clutches. Before we set off into the corridors of server racks, I bend down

to examine the gelatinous contraption, noticing tiny specks of lint, grains of sand, and human

hairs held in suspended animation in the translucent material.

Gabriel adjusts his face mask, "think of it as a first line of defense."

I look up at Gabriel with puzzlement.

"Against everything out *there*."

The "out there" that Gabriel refers to is the everything that isn't "data" and "air" that

flows through the data center; pathogens; particles; anything that might contaminate otherwise

corrupt the "depopulated" and "sterile" (Taylor 2019, p. 4) image of what data centers ought to

be. As I embark on the tour, I notice other signs of nonhuman incursion throughout the complex;

mouse and cockroach traps in the underfloor plenum, where cables are threaded circuitously;

spikes installed on the rooftops to deter pigeons from roosting; and medical-grade filters

mounted to the air vents to catch any microscopic interlopers. Near the end of the tour, Gabriel

elaborates on the HVAC system's defensive capabilities. I learn that Gabriel has the capability to

"pressurize" the ducts and vents on the data center floor to facilitate the rapid expulsion of air,

depriving fuel for a fire before it can spread. When I asked about other uses for this "space age"

mechanism (Murphy 2000), Gabriel replied with a question of his own, "have you ever heard of

Sick Building Syndrome?"
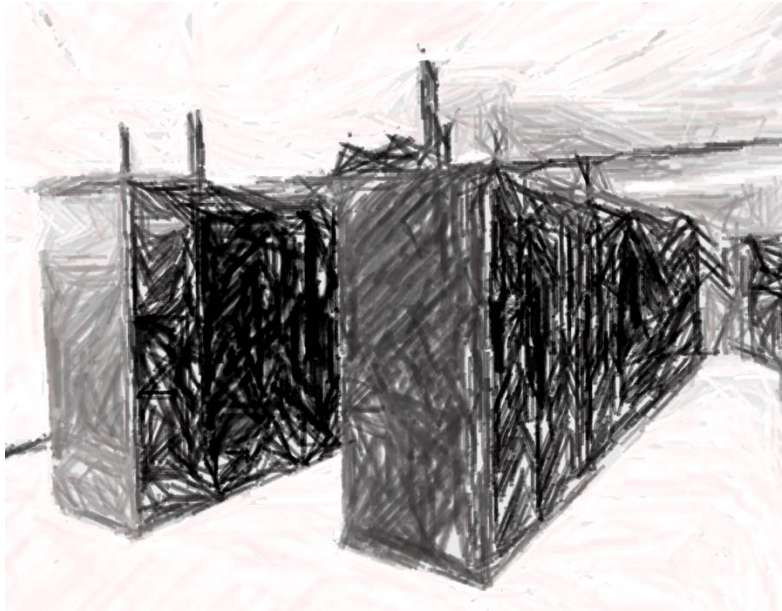
Data Center, Artistic Rendering by Author

Data centers inherit their 'hygienic attitude' (Paxson 2008) from the 1980s , when the

first reports of buildings becoming "sick" started to appear (Murphy 2000, p.2). The triumph of

early twentieth century architects was the "mechanical production of comfort…an odorless,

sweatless… workplace that could painlessly extract labor from bodies" (p. 34). For the workers,

the magic behind the "black box" of their comfort was unknown and few questioned the "effects

of the indoor climate on bodies" (p.23). The 1970s changed that. To promote "energy

efficiency", office buildings were constructed to be "airtight" (p.2), architecturally sealing off the

'information workplace' from the outside world (p.6). Women were among the first to complain

of a gnawing malaise they suspected to be the result of breathing stale air (p. 54), an illness

which would come to be known as "Sick Building Syndrome":

"The tight division between inside and outside made sweating gauche. The solvents that held together the walls, furniture, and cars of material affluence were in their historical infancy…This new built environment spawned consequences. Bodies were assaulted with detritus and effluent, particulate and molecular dangers. Doorknobs passed bacteria and cars spewed exhaust. Dust mites thrived in carpets, consumed the skin flakes of bodies, and we in turn inhaled their excreta. Pesticides suppressed the vermin indoors as much as on the farm. The chemical plumes and wastes of factories and utilities that huddled at the outskirts of urban grids seeped inside unannounced thanks to modern plumbing. All around, objects emitted odorous or, worse, odorless molecules. Yet in delimited spaces, the chaos was seemingly contained. (Murphy 2000, p. 179)

Perhaps aware of this history, Gabriel invoked "Sick Building Syndrome" as yet another threat to be quelled by his digital fortress. The enemy, be they the rogue molecules seeping from building materials, degrading computers, coronavirus particles, or the bacterial slime growing in G703, would be "contained", lest they bring "chaos" to Gabriel's digital order (2000, p. 179). Gabriel indicated to a red "kill switch", the mechanism that would, as might an airlock in a space station, expel the air of the data center's digital "lungs" into the atmosphere. Peter Sloterdijk's genealogy of "air conditioning", begins in the muddied trenches of the first world war's European theater, where billowing plumes of lethal mustard gas inaugurated a new aerial paradigm in modern warfare (Sloterdijk 2009). Over a century later, Gabriel smirks as he reveals the "kill switch". The data center's HVAC system is deployed as a weapon for more-than-human foes. The cloud has its own "microbiopolitics" (Paxson 2008).

Image: IBM Portable Modular Data Center ,CC BY 2.0

In the cramped, hot, and moist environment of "the Mouth", I am reminded of Michelle Murphy's remark that the partitioning of indoors from outdoors "made sweating gauche" (2000, p. 179). Indeed, G703, might be viewed as a regression rather than a novelty in industrial architecture, given that its inhabitants – human or not – are known to "sweat" regularly. Eschewing the thermal "comfort" of Gabriel's primary campus, "the Mouth" is an environment built for machines rather than the men who care for them. It represents a breakdown of Murphy's formulation of "man-in-a-box":

"A building was built with bodies in mind; it became a prosthesis of the body, extending its functions. The body, in turn, became a mobile part of the building" (p. 12)

On the contrary, G703, emblematic of a new "modular" approach to data center design, is notably hostile for the bodies unfortunate enough to work within its walls. This is the price to be paid for "greater energy efficiency", Gabriel once said to me. When I asked about the working

conditions inside the containers, Gabriel dismissed my remark outright, "the modulars practically run themselves, our people spend very little time in there compared to the main building." In a way, the modulars do run "themselves", they "sweat" and cool themselves off, like we do on a hot summer day. Given how infrequently Martin visits "the Mouth", one might argue that eons have passed for the microbes whose timescales and lifespans vastly outpace our own, and the servers that help nourish them, discarded in rubbish heaps in the warehouse after two or three years of service. Like the caves that fascinated Hunner (1904), these data centers have their own microbiomes and microclimates. They breathe. They perspire. As they sweat, information flows, an optical flickering that stitches the world; *cloud hydraulics*.

Irrigating Information

Since as early as 300 BCE, the Hohokam, an ancestral Puebloan people, built a flourishing civilization along the Gila and the Salt rivers, in the region of the upper Sonoran Desert known as the Valley of the Sun (Hegman et al. 2016). By the thirteenth century, the Hohokam had achieved an astonishing mastery of hydraulic infrastructures (Nicholas and Feinman 2019; Hunt 2022; Woodson 2010), constructing sophisticated canal networks, one of which has been renovated to supply water to contemporary residents of the greater Phoenix metro area (Iverson 1988). For a thousand years, the Hohokam and other Ancestral Puebloan peoples thrived in the arid conditions of the Colorado Plateau through the careful manipulation of water resources, irrigating the land to grow squash, beans, maize, tobacco, cotton, and more (Wills et al. 2012). Their influence extended as far south as the Gulf Coast and the Yucatán peninsula, as evidenced by the circulation of turquoise, macaw feathers, and cacao to and from

these distant regions (Hull et al. 2014; Mathiowetz 2019). They were, in a word, "terraformers" (Pak 2016); their hydraulic manipulations transformed an otherwise uninhabitable terrain into an ecology that enabled human flourishing.

Ancestral Pueblo Kivas in Chaco Canyon, Image: Author

The contemporary Zuni identify as the descendants of the Ancestral Puebloans who built the kivas and great houses that still stand in Chaco Canyon, Taos, Mesa Verde and other sites across the Colorado Plateau. On a guided tour of one of these ancient settlements in Arizona, a Zuni tour guide, who I call Mateo[5], inquired about my fieldwork. My detailed questions about the ceremonial functions of kivas must have outed me as something of an anthropologist or an archaeologist. I responded with brevity, relaying my interest in "desert data centers" and their particular reliance on evaporative cooling. Mateo nodded as I prattled on, surprised to learn that the cloud "drinks", as he phrased it. The tour ended in front of a drainage ditch that Mateo

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[5] I refrain from naming the specific Puebloan heritage site to preserve Mateo's anonymity.

assured us was carved by human hands a thousand years prior. With more questions to ask, I lingered, staring out at the remains of the Puebloan aqueduct as I gathered my thoughts, but Mateo had a question of his own: "have you ever heard of Cloud Eater?"

The truth is that I had already encountered this myth – the version recorded by early twentieth century anthropologists (Benedict 1935; Stevenson 1904). I shook my head anyway, eager to hear a twenty-first century retelling by a contemporary Zuni. The following is a reconstruction of that account, based on messy scribblings jotted down in my field notebook at the instruction of Mateo:

In the time of the ancients, there was a terrible drought. As her crops wilted and the sun parched the earth, Grandmother wept. Her tears were the last of the rain to fall in the valley. One day, she searched the sky for moisture, finding that the clouds had mysteriously vanished. Compelled by her curiosity, Grandmother climbed Red Mountain, discovering the culprit behind the valley's desiccation; a gigantic monster. The catastrophe known as Cloud Eater. She watched it greedily gobble up the clouds on the horizon before they could shed their dew to the dusty land below. Grandmother despaired. For she knew that only her grandson, the hero Ahaiyute, was powerful enough to slay the beast, but he had fallen ill with a plague. Moreover, she doubted he had ever encountered anything like this Cloud Eater. She doubted, the old ways for dealing with this kind of nuisance would not prevail. For this was a beast of a manmade sort, filled with thirsty machines that threatened to eradicate humankind and drown the world in dust.

Cloud the "Cloud Eater". Mateo's eyes darkened as he retold the ancestral myth, insisting that the great Ahaiyute was a victim of COVID-19, the "plague" that had so disproportionately impacted indigenous communities living on tribal reservations deprived of basic medical infrastructure (Yellow Horse et al. 2021). His mood shifted to a somewhat playful footing when he recast the great fiend, Cloud Eater (or Cloud Swallower as it is sometimes called), as one of my data centers. The story ended abruptly, with Ahaiyute's convalescence uncertain; this was a

stark departure from Ruth Benedict's triumphant account of Ahaiyute slaying the Cloud Eater, permitting rain to once again nourish the dry land (1935). There was no closure to be found in this pandemic retelling. Just like there was no end in sight to the "plague" that had afflicted Ahaiyute and tens of thousands of indigenous people, or the climate-change fueled drought in the region, in this "era of global boiling", as the UN-Secretary General Antonio Guiterres has declared, nearly two years later (2023).

"Cloud Eater" Image: Mearle, via Tumblr

The day after hearing about the Cloud Eater, I join Gabriel at the urban data center campus, suppressing the details of Mateo's mythical account as we do a walk-through of the courtyard, where "the Mouth" and other modular data centers were arrayed in neat rows. We pause to peer at the drains, where mirky streams of runoff from the containers are swirling in foamy maelstroms of silt. To my eyes, it looks like a confluence of many rivers, only their paths,

narrow channels cut into the concrete, are rectilinear rather than sinuous. "This water, where does it go?"

"The sewer system," Gabriel responds. "The hope is that from there it makes its way back to the aquifer."

"You can't recycle it?"

"We recycle some, pass it through a reverse osmosis filter, but eventually it has to be dumped or our equipment will corrode from the calcium deposits and minerals left behind by the Salt River – this is the *price* we pay for running a data center in a desert."

"So what happens if you run out?"

"Of filters?"

"Of water?"

Gabriel turns his gaze at the gurgling brown soup by our feet. "We are in the middle of a fifteen-year drought. And you know it's something upper management is considering as we expand, especially if the drought doesn't break anytime soon. We're installing more filters, trying to increase what supply remains in closed loop circulation, but I am told that the majority of it will trickle back down to the aquifers when the Monsoon season hits."

I frown visibly, "You're talking about the Albedo effect…the water cycle?"

"Yeah, precisely, so it's not water being wasted. It's going down the drain and not to people's homes, but the important thing is that it's not actually wasted. That's what I'm told. It will trickle back down to the aquifer eventually…when the rains start in late July."[6]

Monsoon season in the Sonoran Desert, Image: Author

Over the two months I worked at the urban data center campus, exchanges with Gabriel were rare occurrences, given his rank in the hierarchy above Martin, Elliot, Jacob, and the other "techs" who worked under him. Seldom did we engage in small talk, and for me, every interaction felt rushed, if not staged to impart a specific technical feature or "official" concern. Perhaps Gabriel feared that Martin's penchant for vulgarity and his Blue-Collar demeanor might leave me with a less sophisticated read of the data center's inner workings. Or maybe he had an image of order that he wanted to project, however tenuous it might be. In any case, I have known

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[6] On this day, I was permitted access to my phone to record the "sounds" of fan equipment with Martin, but the recording kept going in my pocket for the majority of the shift. The dialogue above is a reconstruction of a much longer conversation I had with Gabriel. In many parts of the recording, the voices were unintelligible due to the phone's position in my pocket and the loud background noise of HVAC systems. I relied on field notes and my reflective voice memo to fill in the gaps of what was said for narrative intelligibility.

Gabriel to be a very measured individual, his emotions carefully controlled, his words disciplined. By the drainage system, this veneer waivered, ruffled by doubt, if not fear for the hydraulic futures to come. It began with his use of the word "hope":

 The *hope* is that from there it makes its way back to the aquifer.

Here, the sentence is constructed in such a way as to dislodge the hope from any particular individual who might possess it. Gabriel in particular does not hope – this is a fluid hope, nebulously pitched, for humankind as a whole? For the corporation that runs the data center? Second, another linguistic "distancing" technique Gabriel deploys is to grant the water agency, by making it the "principal" (Goodwin 2007) in the sentence and thereby responsible for its own absence or scarcity; "from there *it makes* its way."

Erving Goffman calls these linguistic sleights, shifts in "footing" (1979). In the Goffmanian microsociological scheme, dialogue is never as it seems. The principal, is what one might call the actor or the one "who is socially responsible for having performed the action done by the original utterance of that talk" (Goodwin 2007, p. 5). In this case, the water is responsible for its availability or disappearance. Ethnographies of corporate culture reveal the inherent tension between the individual and the corporation, especially in a role like Gabriel's where must frequently track between his own views and those held by the corporation; between what he thinks and what he is "told" to say (Cefkin 2022). Gabriel's dance of words, his strategic use of the collective pronoun 'we' in some sentences and not others, is evidence of this kind of behavior:

We [Data Center Corp.] recycle some…

This is the price *we* [Data Center Corp.] pay for running a data center in a desert

We [Humanity] are in the middle of a fifteen-year drought.

In the first two instances, the "we" indicates "official speak", an instance when Gabriel is not the "author" of his words, but is rather the "animator" that brings them about on behalf of the Corporation (Agha 2000;Goffman 1979; Goodwin 2007, p. 5). In the latter, he welcomes me into his "we", perhaps as a way to signal a shared concern or to ease the tension bubbling up in our conversation. In all this, his own position on these matters remains unclear, but a few verbal sleights of hand reveal some degree of divergence from the corporate position. Below, these are indicated in the transcript with italics:

Gabriel: We're installing more filters, trying to increase what supply remains in closed loop circulation, but *I am told* that the majority of it will trickle back down to the aquifers when the Monsoon season hits.

Steven: You're talking about the Albedo effect…the water cycle?"

Gabriel: Yeah, precisely, so it's not water being wasted. It's going down the drain and not to people's homes, but the important thing is that it's not actually wasted. That's *what I'm told*. It will trickle back down to the aquifer eventually…when the rains start in late July

Gabriel's hedging, in particular, his tactically placed "I am told" disclaimers are revelatory. Linguistic anthropologists call these citational constructions, "epistemic markers" (Basso 2007), a linguistic feature that communicates how something is known to the speaker, situating its origin and empirical knowability. "I am told" qualifies the reliability of the claim that the water will return, "eventually". Perhaps Gabriel doubts the corporation's *trickle-down hydraulics* theory, having observed year after year rising temperatures and scarcer rainfall in the aptly named Valley of the Sun. Perhaps the data center's annual water usage metrics have filled him with doubt. Even with a non-disclosure agreement, I was not privy to these numbers nor was

Martin or any other technician part of the elite circle entrusted with this information, which Google and other companies have guarded as "trade secrets" (Mytton 2021). What did Gabriel know that made him doubt?

Amid the ruins of a once-flourishing hydraulic civilization, Mateo bestowed the mantle of Cloud Eater to a data center. The "mechanical beast" was, in Mateo's words, the "catastrophe" behind the "valley's desiccation". Steven Mentz might agree with Mateo – he might say that cloud computing is a "wet catastrophe" (2015, p.1), hastening our course toward the "Naufragocene" (xix), an age of shipwrecks in this "sea" of the digital:

"From 'upstream' networking, 'surfing' the web, 'streaming' media, and data 'flows,' to 'phishing' attacks, 'pirating' and 'torrenting' software, and the 'deep web,' to the terminology of 'blogs' and 'vlogs' apparently borrowed from captains' logs, the web can easily be conferred as liquid: flowing not simply like water but as an untamed ocean" (Hogan 2015, p.7)

Like liquid, data "flows", its unfathomable depths inspire a sense of "oceanic" grandeur, as Mél Hogan observes above (p.7). But the oceanic is just as misleading as the ethereal, if we consider the digital's desiccating materiality. Cloud Eater. A dust bowl, like the Aral Sea, 'terraforming in reverse', to borrow McKenzie Wark's phrasing (2016, p. xiv). Not the "wet shock"(Mentz 2015, p. xxxii) of "saltwater immersion" (p. 27) described in shipwreck narratives, of plunging into the "wild" and "chaotic" depths of nature that wrecked vessels previously kept at bay (p. 26). What is written on Gabriel's face as our conversation ends, as he assures me that water will "trickle back down" to the aquifers beneath us, is a decidedly "dry" shock, "the cost of running a data center in a desert", to restate his words.

An immersed data center, pictured in Silicon Republic, Screenshot by Author

A data center uses as much as 1 to 5 million gallons of water per day to keep its servers cool, which is roughly the equivalent of a town with 10,000 to 50,000 people (Osaka 2023). In terms of volume, that's 1.30×108 m^3 (Ristic et al. 2015, p. 11261). Over one quarter of the world's data centers are located in the United States (p. 11261). Twenty percent of these data centers draw water from vulnerable or highly stressed watersheds (p. 11261). Additional water is consumed indirectly for the production of electricity (Farfan and Lohrmann 2023). The ability to empirically test these figures is limited due to the confidentiality and secrecy surrounding water usage on the part of Big Tech's largest infrastructure developers (Hogan 2018). This fact, coupled with the staggering rate of growth precipitated by "artificial intelligence", makes predictions for future water use difficult (Li et al. 2023). What is available portends massive expansions in water resource usage, as is evidenced by Google's self-reported 20% increase in water use from 2021 to 2022 (Langley 2023). Farfan and Lohrmann predict an increase of .3 to 1.1 m^3 annual per capita water use by 2030 in the EU (2023). The "water woes" of cloud computing are just beginning (Hogan 2015).

Fatehpur Sikri, Image: Pedro, CC BY 2.0

A historical view on the use of water for cooling, connects *cloud hydraulics* to a much longer technological genealogy. Fatehpur Sikri, once the capital of the Mughal Empire in the late fourteenth century, is emblematic of this hydraulic history. Mughal architects constructed pools, fountains, and canals to reproduce the 'flowing rivers' of the garden paradise promised in the Qu'ran (Ali 2013, Maddern 2001). In the more arid parts of the Empire, these simulacra of the 'flowing rivers' of paradise pass through building interiors, drawing away heat with them (Ali 2013, p. 17). *Salsabil*, which refers to the bubbling springs found in paradise, were erected throughout building complexes on "inclined stone slab[s] with wavy patterns" that increase the humidity dispersed into the air as tiny droplets evaporate (p.22-23). A predecessor to air conditioning, this method of "natural cooling" (Alcalá 1999; 476) by "evapo-transpiration" (Ali 2013, p. 17), enabled Islamic empires to engineer a "modified microclimate" (Alcalá 1999; 476) in their palaces, ceremonial centers, and gardens.

In the atomic age, this same "natural circulation" water-cooling method would be updated for use in Nuclear Power Plants (Reyes 2005, p.17). Like data centers, however, nuclear power plants require enormous quantities of water to cool their reactors. In France, climate change is threatening energy security as increasing summer temperatures and drought are diminishing water resources (Barber 2022, Vujasin 2023). Unlike Gabriel's data center campus, however, these nuclear reactors were not deliberately built in a desert (even if that might be what France is slowly becoming). In our exchange, Gabriel mentioned the "price" of building a data center in a desert, citing the nuisance of desert particulates, but not the more existential crisis of water availability in a region that he admits is in the midst of a historic "megadrought" the likes of which have not been experienced since the time of the Ancestral Puebloans (Williams et al. 2022). Gabriel's disregard of this obvious hydraulic constraint is notable. His "hope" and insistence that the water will "trickle back down" to the aquifers is consistent with a larger conceit of Big Tech, that Mél Hogan spells out below:

Big Tech has mandated itself to be responsible and to manage natural resources sustainably, premised on the logic of natural balance – i.e. that as long as nature returns to a state of homeostasis, and as long as companies work to replenish what they use, it follows that the development of communications infrastructure is a (two-fold) sign of progress (2018, p. 634)

Gabriel's "trickle down hydraulics" are drawn from an industry playbook that "rationalize[s] its ongoing expansions" (2018, p. 632), even if such expansions are unsustainable, if not outright self-destructive.

"What happens if they run out?"

This was the question I asked Gabriel, referring to the Valley's scarce water resources. Gabriel responded, redirecting the conversation to filters, the technological means to extract the "desert"

from the water for the benefit of computation's hydraulic metabolism. This paradoxical

blindness to ecological precarity as a result of global heating suggests that there is more to the

ecology of data centers than the material affordances of climate and environment.

NBC News Article, Screenshot by Author

On June 19th, I stopped by a coffee shop in downtown Mesa to review my notes and

prepare for my shift at the data center later that afternoon. Google algorithms, having thoroughly

mined my search history and metadata, referred me to an article published in NBC News, called

"Drought-stricken communities push back against data centers" (Solon 2021). I scrolled through,

intrigued by the article's protagonist, a sole dissenting voice in city leadership who opposed the

construction of further data centers in the Valley, citing their water use and their lack of jobs.

Vice Mayor Jenn Duff, a local of Mesa, agreed to chat with me on the phone later that afternoon,

after I emailed her office. In our phone conversation, Duff decried the industry's failure to

provide local economic benefit, offering few jobs and using a tremendous share of electricity and

water resources.

They [the data centers] come at a great cost. Someone has to stand up to them. I'm that someone for now.

Our conversation quickly shifted to the politics of data centers in Arizona. The perfect storm of cheap hydroelectric power, desert aridity, tax incentives, and a state government stocked with officials who openly deny the existence of climate change. The story of Arizona data centers is no longer a story about the material constraints of desert environments but the economic and political currents twined in its "ecology" (West 2016).

Image: Teresa Davis, ABQ Journal

As Nikhil Anand reveals, hydraulics are politics (2017). In Valencia, New Mexico, farmers are directly competing with data centers for access to water (Davis 2021), leading Mél Hogan to the conclusion that "Big Tech are the new farmers" (2018, p. 633). In their bid to achieve hydraulic justice from local governments, they invoked, "water is life", a refrain first chanted by indigenous activists at Standing Rock (Estes and Dhillon 2019). In the drought-afflicted Castilla La Mancha region of Spain, a similar dynamic is unfolding. As farmers anticipate a ninety percent loss in their grain harvest, as a result of water rationing, Meta is constructing a data center in nearby Talavera de la Reina that is expected to use 176 million gallons of water per year, or "195 liters per second during 'peak water flow'" (Hernanz Lizarraga and Solon 2023). In Uruguay, a state of emergency has been declared. Authorities have taken the

unprecedented step of adding "salty water to the public drinking water supply" to compensate for drought, sparking widespread protests (Livingstone 2023). Meanwhile, Google has acquired 72 acres of land to construct a new data center in the south that will use an anticipated 2 million gallons of water a day to cool its servers, the equivalent domestic water footprint of 55,000 people (Livingstone 2023). Such dynamics are examples of the Cloud's political ecology, or what Sebastian Lehuede calls "the infrastructure of data colonialism" (2022, p. 5).

In her ethnography of the technocratic machinery of aquifer management and future making in Costa Rica and Brazil, Andrea Ballestero calls for an "extended materiality" of water, urging scholars to consider how "colored slips of paper" and "water bills" become enrolled in that materiality (2019, p. 191). Water's "availability", Ballestero argues, is as much about Gabriel's "hopeful" *trickle down hydraulics* as it is about the "transubstantiation of water" into a commodity or a set of statistics that epistemologically stabilize its fluidity for bureaucratic manipulation (p. 187). Heeding this call, I argue here that the Cloud is liquid; the information it precipitates is irrigated, like the crops that the Hohokam once raised on the banks of the Salt River. Cloud Eater. The "wet catastrophe" (Mentz 2015, p.1). Water's material flows must be understood within the larger "metabolism" of computation (Moore 2017). In the Anthropocene, they cannot be disaggregated, especially as Big Tech consolidates its grip on Nature as both its fuel and the project it hopes to "fix' through its construction of renewable energy infrastructure (Hogan 2018). By serving as Nature's champion and by harnessing its affordances – the cold of its poles and the aridity of its deserts – to expand unchecked, computation is 'naturalized' (Johnson 2019). Furthermore, these political dimensions of its ecology are obscured, as Big Tech displays a greater commitment to decarbonization and sustainability than most governments:

We are in a moment of convergence, handing over not only nature to Big Tech (from the commons), but also the very concept of 'the natural' and what it might encompass. (Hogan 2018, p. 634).

Pockets of resistance are fomenting (Lehuéde 2022) against this expansion, especially in the deserts where data centers are increasingly sited. The question remains, why deserts? How are "desert data centers" activating deeper histories of deserts as laboratories, sanctuaries, bunkers, or sacrificial zones?

Disk Desagüe

"Welcome to the space colony," Elliot, a junior technician tells me, as I study one of the "carcasses" on our pushcart. The U-Server, as it is called, is limned with rust and whiteish stains. I resume pushing the cart toward the warehouse, where we will use a powerful magnet to wipe the drive's contents, ending its "life".

"So that white stuff is from the atmosphere?" I ask, speaking over the din of the wheels on the concrete.

"No, it comes from the water," Elliot sighs as we make our way into the courtyard, the sun bright and hot in the arid sky. "Things don't last long in G601. I told Gabriel we need to adjust the humidity in there, too much of the chlorides are getting through. I think the mister is set too high."

"Yeah, I heard about the sediment corrosion."

Elliot squints at the bright sky, "sediments, snakes, one hundred and twenty degree heat. Everything about this place is actively trying to kill us. We don't belong here. I mean, we are literally in a desert and people have lawns with green grass. I don't get Arizona."

"You're not from here?"

"The space colony?" Elliot chuckles, "Definitely not. I'm from Michigan."

Corrosive effects of chlorides on data center equipment, Image: Artistic Rendering by Author

Elliot, one of many waves of recent newcomers to the Valley of the Sun, jokes that Phoenix is a "space colony", citing its ecological hostility to computers and their human counterparts. "We don't belong here," he tells me, perhaps also remarking on the history of indigenous dispossession and violence that preceded the establishment of Phoenix with the construction of Fort McDowell in the late nineteenth century as a bulwark against "Indian uprisings" (Alflen 2011). Elliot invokes "space colony" to describe this city in the heart of the

Sonoran Desert, suggesting a deep link between American desert discourse and the science fictional (Lorenz et al. 2014;Tuzun 2018; Womack 2013). From Arthur C. Clarke's first novel *The Sands of Mars* (Lorenz et. al 2014) to Frank Herbert's *Dune* (Gaspar de Freitas 2022)*,* deserts have captured the American imagination as future wastelands wrought by ecological catastrophe or nuclear war (Tuzun 2018; Wark 2015, p. 185; Womack 2013), or nostalgic echoes of "Manifest Destiny" in a vast universe of unsettled planets that serve as psychic doubles for the American West (Abbot 2006; Katerberg 2008; Lepselter 2016; Masco 2020, p. 84).

The Valley of the Sun by Air, Image: Author

In Abu Dhabi, the engineers and entrepreneurs behind the "futuristic" Masdar City, might embrace Elliot's science fictional characterization of desert settlements, though they would prefer the term "spaceship" (Günel 2019) over "space colony." Gökçe Günel ethnographically documents the emergence of this "high tech oasis" (p. 38), which Günel describes as an

"experimental hub" that partitions an "uninhabitable environmental outside" from a "desert utopia" ruled by a "rational scientific" managerial order (p.41). Just 111 miles (178 km) outside of Phoenix en route to Tucson, sits Biosphere 2, which Günel cites as an inspiration or template for the kind of containerized ecotopia that Masdar City techno-enthusiasts hope to bring about (p. 42). When I visited Biosphere 2, I learned on a self-guided tour of the facility of its history as a "prototype station for future space missions"; a proof-of-concept in terraforming, constructed to test "whether life inside the structure would regulate itself and from conditions that are favorable for human life in a similar way as happened in the evolution of life on earth" (Walter and Lambrecht 2004, p. 267). To borrow Elliot's language, Biosphere 2 was quite "literally", a "space colony":

"Engineered to be a self-sustaining mesocosm, almost completely sealed off from atmospheric or other material exchange with the outside world, the graceful three-acre enclosure houses nearly 4000 introduced species of plants and animals in a Garden-of-Eden-like setting of tropical rainforest, marsh, desert, savannah, streams, agricultural area, and even a miniature ocean complete with coral reef. Biosphere 2 receives energy as sunlight and as electricity (from an adjacent natural-gas power plant) that drives a vast 'technosphere' of pumps, sensors, scrubbers, air-cooling systems, and other electronic and engineering wizardry designed to keep the environmental systems within boundaries suitable for life (Avice 1994, p. 327)."

On September 26th, 1991, eight scientists famously committed to sealing themselves within the "self-sustaining environment" (Walter and Lambrecht 2004, p. 274) of Biosphere 2, a simulation that would test the viability of "materially closed system" and its capacity to maintain "equilibrium" for the human beings (Biospherians) and the "artificial ecosystems" it contained (p. 267). Two years later, the scientists re-emerged from the habitat, malnourished and ill from microclimatic and atmospheric imbalances (too much carbon dioxide, insufficient oxygen). Among the numerous instructive failures was the partitioning of ecosystems, as the "desert

biome" was infamously overtaken by greenhouse ants and cockroaches, due to the presence of

too much moisture (p. 272). After a second mission in 1994 resulted in scandals and costly

failures, the Biosphere 2 was sold off, eventually acquired by the University of Arizona, who

continues to conduct ecosystem experiments, while also facilitating educational programs, like

my self-guided tour.

Biosphere 2 in Arizona, Image: Author

As I weaved through diverse habitats housed within the glass and steel structures –

everything from rain forests to oceans to steppes and deserts – I took note of the visible

ventilation ducts that kept made these terran simulacra possible. Even with an n95 mask snug on

my skull, I could sense the changes in air density and moisture as I shifted from one world to

another. Biosphere 2's microclimates, like the Cloud's, were carefully engineered to repel the

desert "out there", to create "manmade weather" (Cooper 1998) that would support an entire

ecosystem. This was much more than Murphy's "man-in-a-box" (2000), this was a willful act of

terraforming (Wark 2015), bolstered by Cold War space race currents, to fulfill the "dream of

sending man to Mars" (Walter and Lambrecht 2004, p. 267, 274). Behind it all, were those ducts, an HVAC system that filtered air, that in 1991, failed spectacularly to stave off the "disorderly wetness" (Mentz 2015, p. xxxii) that unmakes deserts.

In desert data centers, moisture is a chaotic element that at once cools and corrodes (Shah et al. 2016). The wet and the dry make for awkward dance partners, Steven Mentz notes (2015 xxxii): "drying fictions float uneasily in the inhospitable ocean" (p. 1-2). Aridity is preferred over humidity, as the old adage "it's a dry heat", implies (Cooper 1998). Dryness is "conceptual" (Mentz 2015, p. xxxii), wetness a path to ennui and formlessness. Biosphere 2 operates under the premise that "ecology will right itself", if left undisturbed (Wark 2016, p. 200), an axiom that feels increasingly more delusional as Earth becomes "a Mars", "estranged from its own ecology" (p. 186) by climate change. Trickle down hydraulics. While discussing the environmental impact of the construction of data centers and the solar farms that companies are financing to offset their grid electricity usage, Gabriel remarked on the "thousands" of rattlesnakes that had to be "cleared" to secure the construction perimeter for a new campus:

"They did the studies, they made sure they took care to – we're deploying this, but we are, we're *changing the desert* to do this, you know, and, it's for the greater good to produce the solar power that it does" (emphasis mine)

Above, Gabriel admits to "changing the desert", acknowledging how building new data centers and solar farms are disrupting the fragile ecosystems in the Sonoran Desert, but he fails to account for how the water footprint of his facility is further drying out the land. For the executives who are building these new data centers, what hydraulic future do they anticipate but total desiccation?

México city of Tenochtitlán, circa 1521. Image: Second Letter of Hernán Cortés. Nuremberg: F. P

In front of a crowd of hushed onlookers, Luis de Velasco, the second Viceroy of New Spain, dug excavated a tiny handful of red dirt, inaugurating with fanfare a "massive hydraulic project intended to drain the lakes that surrounded the City of Mexico" (Candiani 2014, p.1). This Real Desagüe de Huehuetoca, as it was called, sought to bring about the "total desiccation" (p. 316) of the lakes that the Mexica empire had engineered for their floating farms, the chinampas (p. 23, 27, 55). The Spanish Crown, aware that the indigenous peoples under their rule utilized wetland ecosystems for subsistence and medicine (p. xxvii-xxviii), hope to bring about another decisive symbolic and material victory over their subjects who they still feared as savage enemies (p. 285). In the southwestern United States, data centers are clustering to the parched desert to profit from cheap power and dry air, bringing about a Desagüe of their own. This is permissible in the deserts of the American West, where the majority of indigenous

reservations are situated and where Cold War experiments such as the Trinity Test took place, irreversibly dooming a landscape and the people within it. Why is this disk Desagüe permitted? What makes this desert – and those that reside within it – exceptional, expendable even?

Joseph Masco offers the following observation about Las Vegas, the other major "space colony" in the American southwest:

At the turn of the century, Las Vegas was the fastest growing city in the United States, consuming water as if it were surrounded by an ocean of fresh water. It is also a desert island within a military-industrial crypto-state, a place where secret military machines are designed, where atomic bombs are detonated, and where chemical weapons and nuclear waste are stored; it is a home, in other words, to all the national security technoscience supporting a superpowered military state founded in settler colonialism (2020, p. 84).

Masco observes a similar pattern of willful (if not suicidal) ecological depletion, of hastening the arrival of an inhospitable 'Mars on Earth' (Wark 2015, p. 186) in Nevada's desert metropolis. Like Phoenix, Las Vegas is an already "dystopian" landscape, expanding rapidly under a techno-optimist vision of "utopian potential", which remains haunted by the realities of ongoing settler colonialism and a military industrial complex that could, at any moment, bring about the extermination of all life on Earth (Masco 2020, p. 84). Masco narrates these "practices of cognitive erasure" as "imaginative work" that positions the desert as "an existential blank page" with the "appearance of pristine possibility" (p. 84). In my chapter, "Cloud Clamor", I detail some of the violent "tactical amnesias and temporal sutures" that Valley residents rely upon to narrate their fraught belonging in a settler state (p. 84). For many of my informants, the American West is an imaginary (Lepselter 2016) latched to a "cosmology of progress" and "utopian expectation" (Masco 2020, p. 84). Masco labels these interlocking and contradictory expectations, built on violent omissions, "desert modernism" (p. 84). This "conceptual

enterprise", as Masco defines it, "perennially reinvents the desert as dreamspace for a hyperviolent idea of progress" built on nuclear nationalism and settler colonialism (p. 84). Terra nullis. Tabula Rasa. A desert that is an expendable nowhere, a proxy for extraterrestrial settlement, a toxic dump, or a natural accomplice to the carceral state's extrajuridical violence against migrants.

In the late nineteenth century, Death Valley, so named for the many lives claimed by its extreme weather, was deemed by a local sheriff to be "a place outside of society's socioeconomic and legal boundaries" (Kharpertian 2020, p. 22), "where money has no purpose" (p. 26). The desert was as much of a killer as the people he was dispatched to bring to justice. I am reminded of Elliot's description of Arizona as a "a place that is actively trying to kill us". In his grisly ethnography of the US Border, Jason De León details how the United States Border Patrol wields "the desert as a weapon" (2015, p. 36) against would-be migrants from Central America. Like the Sheriff in turn of the century Death Valley, the carceral state relies on the desert's "exceptional[ity]" (p.28) to "operationalize necroviolence" (p. 71), 'outsourcing' their violence to "Nature", and thereby exculpating themselves from willful murder (p. 73).

It is no accident that the densest cluster of data centers in the world is located within an hour's drive of the United States capitol, where signal and electrical infrastructure is hyperredundant, and US military patrol presence deters cyberterror. The desert is similarly a bulwark against unwanted incursions, as Mél Hogan observes at the National Security Administration's Utah Data Center:

The NSA's main storage site…boring architecture, presumably designed to be anonymous—is located… on an unmarked road off of Camp Williams Road, a highway outside Salt Lake City…Guarded, with dogs and cameras, the data center is deemed off limits as highly protected federal property. To merely inquire about its location is

nerve-wracking and quickly begins to feel like intellectual trespass. Post 9/11, and with ongoing US-led airstrikes and drone development and deployment, it is difficult not to imagine the site as somewhat exposed from above, a vulnerable target presumably all too easily watched or infiltrated from the skies. (2015, p. 3)

Like A.R.E. Taylor's "underground clouds", "desert clouds" are still ruled by the "defensive logics of the bunker" (2023, p. 417), and therefore the desert environment's hostility and remoteness, doubly safeguard the data. Nature is "outsourced" as an additional security detail, to borrow De León's phrasing (2015, p. 73).

The "secrecy" and atmosphere of extraterritoriality ascribed to deserts within this desert modernist complex, also position deserts as ideal laboratories (Masco 2020, p. 84). Biosphere 2 is one of many examples of deserts as experimental zones. In Chile, the "pristine skies" of the Atacama Desert have attracted American and European researchers, who have constructed observatories to capture astronomical data (Lehuéde 2022, p. 2-3). Buoyed by the success of the observatories, Chilean policy-makers hope to leverage the nation's "geophysical singularities" to "attract world-leading research infrastructure" to exploit the "natural laboratories" unique to the region (p. 7-8). Data centers, attracted by the region's cool and arid desert climate, are flocking to Chile, hoping to realize "Datagonia", a series of 'innovative' data centers that use volcanic rocks to increase airflow and are built to be invisible, 'sinking into the natural landscape' and supporting a vast recreational park 'on top of them' (Lehuéde 2022, p. 10).

The few, the proud, the cold

Ralf Auer, left, and Steve Barnet, right, with James Roth of the IceCube team, dressed for a walk to the IceCube data center.

IT crew for the IceCube WIPAC data center, Image: Ars Technica

Data centers flock to deserts, harnessing their aridity to more efficiently keep cool, draining watersheds in the process, a new read on Jeffrey Moro's diagnosis of "elemental irony" (2022). There is, however, such a thing as too dry. If too thoroughly desiccated, disks die:

In the beginning, we prayed a lot. We lost a lot of drives. We were still learning. This isn't something you can't easily test in a lab setting or a simulation, these extremes are found nowhere else on the planet.

Above, is an excerpt of a preliminary interview I conducted with Jim Madsen, executive director of the Wisconsin IceCube Particle Astrophysics Center, or WIPAC. In the "technocratic Antarctic", Jessica O'Reilly's sobriquet for the south pole (2017), research initiatives like WIPAC have data storage requirements (Aartsen et al. 2015). "Geography dictates the build", writes Celia Villarrubia in *Data Center Dynamics* (2014), opining on "extreme" data centers. At WIPAC, data center technicians are primed for altogether different ecology of computing; wherein extremes of altitude, temperature, and aridity transform the human body into a superconductor. Static electricity is a threat to servers, when there is no ambient humidity,

requiring technicians to wear "anti-static jackets" and "ground" themselves before handling

equipment (Gallagher 2012). When exterior temperatures are anywhere from -40 F to -100 F, air

must be heated rather than chilled before it can cycle through servers (Gallagher 2012; Velkova

2016). Technicians like Steve Barnet are pushed to their metabolic limits, as oxygen at 9,300 feet

above sea level is scarce , and even routine repairs can be exhausting (Gallagher 2012). Here,

Michelle Murphy's paradigm of "man-in-a-box" reaches its uppermost threshold of tolerance

(2000). In the south pole, servers, like their stewards, are incredibly fragile, teetering on the brink

of destruction, desiccated and overcooled. This is one edge of what I am calling computing's

'limit' ecology (Helmreich 2011). The other, is a place of opposite extremes; of "chaotic"

moisture (Mentz 2015) and "melting" heat (Hobart 2023), the wild, wet foe of coloniality that

Velasco's Desagüe failed to wring out (Candiani 2014).

Colonial Condensations

Below us, the city rises up like a set of overcrowded teeth, high-rise buildings jutting up

between clumps of greenery cross-cut by drainage canals with gently flowing water, browned by

jungle silts. This side of Singapore, the Kallang district, is quieter, and less ostentatious than the

downtown with is gardens and gleaming, solarpunkish skyscrapers. My guide to this place, Li,

permits me to take a photograph, a rare occurrence in my fieldwork in the data center industry.

We sit in the cafeteria, with the panorama of the island city-state surrounding us, as I ask

questions about Singapore's booming data center sector.

View from Data Center Office Building, Image: Author

 "For your notes, you should write this down," Li says, pointing to my field notebook, watching with keen eyes as I scribble his words as neatly as I can, jittery under his scrutiny. "What we do here in Singapore will change the world."

I nod, continuing to scribble as Li explains the challenges of creating a data center hub on an island with little real estate and limited power infrastructure. "These constraints create the right conditions for innovation. It's like evolution; under great pressure, species change or die out. We choose the former."

"So, the Tropical Data Centre (TDC) project, is an example of this…adaptation?"

Li nods, "Computers weren't designed to operate here. Such extremes of heat and humidity require enormous amounts of energy to cool servers. So we partnered with the

government to run an experiment to test what will happen if we push beyond the recommended operating guidelines."

"And what have you found so far?"

"The servers degrade faster, but they work with greater reliability than anticipated. This is promising. But there are still practical challenges."

I take a guess, "for the technicians?"

Li adjusts his glasses, "yes, we are trying to determine if it will be safe for them to work in those conditions long-term."

As Li elaborated on the occupational health standards for data center workers, I could not help but think of the "sauna" environment I experienced in "the Mouth".
In material opposition to Steve Barnet's cold and arid IceCube data center, might be Li's hot and humid TDC experiment, the opposite edge of computing's limit ecology:

Li: what will happen if we push beyond the recommended operating guidelines?

Above, Li spells out the rationale for the TDC project, but to me it sounds like a manifesto. When discussing Singapore's future, Li invokes Foster's rule – or the "island effect" in evolutionary biogeography (Lokatis and Jeschke 2018) – insisting that the island-nation's unique "constraints" (its tropicality; its small size and limited energy resources) might lead it to "change

the world." One could read Li's remark as consistent with the technocratic sensibility and "experimental ecology" (Fischer 2013, p. 380) that anthropologists have found to be pervasive in Singaporean business culture. I argue, however, that Li's eagerness to "push beyond" ASHRAE (American Society for Heating Refrigeration Air-Conditioning Engineers) guidelines, belies a bold geopolitical aim; to surpass "the West" by tropicalizing computation.

Downtown Singapore, Image: Author

In 2003, the Singaporean government launched the Biopolis project, a "life sciences technopole that brings key Singaporean biomedical research institutes together with global and local biotechnology and pharmaceutical companies and governance bodies" (Waldby 2009). Anthropologists are framing the rise of the Biopolis project as an effort to curate a national character that is ostensibly modern and irrefutably Asian (Fischer 2013, Ong 2016). Amid the fallout from the SARS outbreak, biopolis emerged as a response to "fears of pandemics, climate change, destruction of biodiversity, and toxicities produced by industrial agriculture and

manufacturing" (Fischer 2013; p. 379). Long a crossroads and "gateway" through Asia, this Biopolis-era Singapore styles itself as "cosmo-political" (Fischer 2013, p. 402), asserting an "English modernity" (Lim et al. 2010) and multicultural ethos, through its institutionalization of multilingualism for its Mandarin, Tamil, Bahasa Malay, English and "Singlish"-speaking citizenry (Wee 2006). Aihwa Ong observes how the promise of genomics research in Biopolis lies in its capacity to "project" an image of Asian modernity as innovative, pragmatic, and cosmopolitan in a ways that surpass the Global North, creating a model to be exported globally (2016):

Li: what we do here in Singapore could change the world

Michael Fischer observes that "a key driver is the intense interest in the promise of the life sciences not simply to provide more medicines but to provide insight into the repair mechanisms within biologies and their habitats, to work with rather than against nature (p 401)." We can see how this ethos of 'working with rather than against nature' plays out in Li's TDC experiment, which aims to embrace ambient tropical conditions in an effort to conserve energy (p. 401).

Where there is biopolis, "datapolis" must follow (Gurashi 2023, p.3). Data centers first appeared in Singapore as the "computational architecture" behind the genomics boom (Ong 2016, 37-39). Additionally, technocratic governance and surveillance projects like Smart Nation Singapore, digitized over ninety percent of citizen services creating the need for robust data storage infrastructures (Gurashi 2023, p.3). Rather than a centralized internet infrastructure, the data centers, internet exchange points, and telecom hubs, cohered as a "patchwork territory" with a "diverse topography" that enfolded multinational tech companies with government agencies

(Graham et al. 2018, p. 3; Neilson and Rossiter 2022). By the 2010s, Singapore emerged as "Asia Pacific's Data Center Capital", the undisputed "hub of internet infrastructure" in the region, a result of its technocratic orientation, 'business-friendly' tax structure, "geographic location, colonial history, and position as a hub in the global undersea cable network" (Starosielski 2021, p. 213). Its key "disadvantage" (p. 213) or "constraint", as Li defines it, is a tropical climate that is hot and humid, making cooling a particularly energy-intensive activity since the evaporative cooling techniques used in the "desert data centers" of the American southwest are not viable.

Like colonial programs in tropical medicine that sought to solve specifically "tropical" diseases said to foil the modernization of tropical colonies (Candiani 2014, Redfield 2000, Soto Laveaga 2009), the TDC strives to solve the metabolic challenges of tropical computation that make the modernizing project of datapolis challenging to fulfill. In the alien conditions of the tropics, European colonists framed heat and humidity as a contaminant. Colonial administrators reported a persistent "tropical inertia," a "depleting," "destabilizing" atmosphere that "enfeebled" the intellect, vigor and fecundity of White men "sacrificing" their health to bring civilization to colonies (Anderson, 1997: 1346, 1353, 1366). Bourgeois White masculinity withered in the miasma of "deforming" heat, especially the "mental apparatuses" of White men which were "better matched" to the cool, temperate conditions of the European metropole (Anderson, 1997:1366). The data center industry's figuration of the tropics as a "challenge" to overcome (Ong 2008, p. 121), is an echo of the colonial encounter and the emergence of "tropical medicine" and anthropology as "tropical discipline" (Ruamcharoen 2022; Redfield 2000, p. 15). The data center, like the "white Euro-American body" is particularly vulnerable to

tropicality's "environmental otherness", though for servers, the perils are not "poisonous plants, omnipresent pests, and febrile diseases" but "hot and humid air" (Ruamcharoen 2022, p. 2).

Narrating the history of the portable radio used by the U.S. military in the World War II's pacific theater and later, Vietnam, Chayanon Ruamcharoen writes that "tropicalization" was the "countermeasure" to "tropical deterioration", the destruction of early radio equipment by fungal growth in the tropical air (2022, p. 2). *Tropicalization* is a design ideology that seeks to prevent "decomposition" through the "manipulation of air" (p. 5). Ruamcharoen explains that this shift toward "tropical thinking" (p. 3), was a "means…[of] curating decay" (p. 5), preventing fungal growth by 'hermetically sealing' off the electronics from "dangerous atmospheric air" (p. 24). This project in "American tropical triumphalism" (Sutter 2007), was predicated on an "ecological understanding of technology [that] ran counter to a place-neutral understanding of technology, on which technology works identically regardless of place" (27). Like these portable radios, which were initially designed with a temperate atmospheric bias, servers are similarly constructed to be hydrophobic and humidity-averse, as the ASHRAE operating guidelines below indicate:

The technology and computer equipment found in data centers can be very sensitive to environmental conditions such as temperature, humidity, dew point, water and power loss. For example, if the temperature or *humidity is too high*, your data center is at serious risk for equipment overheating/failure, irreversible data loss, warping of materials and hardware corrosion. Temperature or humidity that is too low can lead to electrostatic discharge (ESD), which can cause damage to sensitive components…ASHRAE recommends an *acceptable relative humidity range* of 20 and 80%. However, in environments with high levels of both copper and silver corrosion, ASHRAE states that the *upper moisture level* should be kept below 60% RH, possibly lower than 50%. (ASHRAE 2021, emphasis mine).

In Singapore, where the mean annual relative humidity outdoors is above this "upper moisture level" threshold of 80% (Aik et al. 2020; Chang and Ng 2021; Cheung et al. 2021), Li is not exaggerating when he decries to me that "computers weren't designed to operate here." This climatic disparity creates an uneven 'media ecology' (Furuhata 2022), where data centers are exported to all environments as modular "islands" or "fortresses" (Hogan 2018, p. 639) premised on the notion that "technology works identically regardless of place" (Ruamcharoen 2022, p. 27).

Li, eager to see the TDC "change the world" by "pushing beyond" temperate-biased ASHRAE guidelines, by tropicalizing computation, by "working with rather than against Nature" (Fischer 2013, p. 401), is challenged what Nicole Starosielski identifies as "a regime of thermopower" that reproduces colonial topographies (Starosielski 2021):

The push toward ecological computing, especially in efficiency metrics, continues to privilege not only the Western domination of internet infrastructure but also the hyperscale operators such as Google and Facebook that can afford to manipulate temperature at such an expansive degree and using artificial intelligence. The privileging of security, redundancy, and reliability and the tying of these
analytics to the *cold* help to striate internet infrastructure and to ground it in locations where temperature and politics appear to remain "friendly." As an alternative, there are many other ways of approaching the problem of overheating that don't leverage climate: decreasing the amount of communication, spatially distributing computation, and investing in alternative energy, to name a few. Such options remain marginal, if considered at all, as our contemporary mediascape remains embedded in a regime of thermopower that prioritizes precise thermal management which, in turn, is justified by the threat of climate change. (p. 216)

Spurred by this geopolitical inequity, and wider "cultural shifts towards biological and ecological sensibilities" (Fischer 2013; p. 379) in Singapore, Li's tropical contestation might be read as a

postcolonial "data territorialization" (Lehuéde 2022). Brett Neilson and Ned Rossiter locate

"territorial logics" at play in Singapore's "datapolis" (2022, p. 3):

Data centres command a power to connect agencies and their economic interests across the territory of cities, nation-states and continents. As a region hosting an ever-growing number of data centres, Asia is positioning itself within a geopolitical and economic constellation endowed with a capacity to govern and control data economies and financial transactions beyond traditionally defined geographical and cultural limits. The interoperability between data transmissions and transactions occurs in tandem with technical specifications and information architectures related to Internet protocols, storage media, cable infrastructure, database systems and hardware design. Also relevant are commercial trade agreements and juridical frameworks specific to the regulatory regimes of nation-states (p.7)

By tropicalizing computation, Li, in a direct partnership with the Singaporean government, is furthering the viability of datapolis and its expansion. Perhaps Li, and by extension, the Singaporean state, is resisting the wider dynamic of "data colonialism" that Sebastian Lehuéde reports in Chile, where the indigenous Lickan Acktay peoples are being displaced by data center construction projects (Au 2022; Lehuéde 2022). Or through their experimentation and redefinition of boundaries, do they hope to assert what Hi'ilei Julia Kawehipuaakahaopulani Hobart calls "thermal sovereignty" (2023, p. 137)? Or, is Li looking to the future, anticipating a deluge of infrastructure growth and climate disasters as artificial intelligence surges?

Data Deluge[7]

In the warming cauldron of the Caribbean Sea, it spawned; a maelstrom of spiraling cloud meteorologists named Fiona. On September 18, 2022, it made landfall as a Category 1 hurricane over the occupied U.S. territory known as Puerto Rico, nearly five years to the day after Hurricane María, devastated the archipelago in 2017. Hours before its whirling shadow darkened Puerto Rico's shores, Fiona's outermost tendrils of wind and rain obliterated the island's electricity grid. Fiona, a Category 1 storm (at 165 km/h), was feeble by comparison to María (at 270 km/h), but just as effective at decimating the island's aging energy infrastructure (Keellings and Hernández Ayala 2019). Puerto Rico plunged into darkness.

The private company LUMA Energy succeeded the state-operated Puerto Rico Electric Power Authority (PREPA) in the summer of 2021, promising greater reliability and resilience. But a year of intermittent blackouts and skyrocketing energy prices has left Puerto Ricans disillusioned with the Canadian-American company's management of their crumbling energy grid (De Onís 2022; Gonzalez 2022). In response, Puerto Ricans initiated protests against LUMA Energy and the US-appointed Fiscal Oversight and Management Board of Puerto Rico (known colloquially as La Junta) for its hand in privatizing the archipelago's power infrastructure (De Onís 2022). Just as Puerto Ricans ousted former Governor Ricardo Rosselló through massive demonstrations (Alvarado León 2019), the people are demanding the cancellation of LUMA Energy's contract with the local government (O'Connell-Domenech 2022).

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[7] A version of this chapter appears as an article in *Anthropology News*: Gonzalez Monserrate, Steven. 2023. "La Nube sin Apagón." *Anthropology News* website, January 5, 2023.

A perfect storm of anti-imperial sentiment is sweeping over the archipelago (Walters et al. 2019), spurred by multiple intersecting disasters and their tumultuous 'aftershocks' (Bonilla and LeBrón 2019): a government debt crisis (Stojanovic and David 2022), Hurricane Irma, Hurricane María (Bonilla 2020), COVID-19 (Garriga-López 2020), the 2020 earthquakes (Mazzei 2020), climate change-fueled drought (NCEI 2022), corruption (Gamboa 2022), a housing crisis (Barron 2018; Graulau 2021; Marín González 2020; Torres Gotay 2017), cryptocolonialism (Bowles 2018; Ottenhoff 2021), and Hurricane Fiona (Bonilla 2022). At the front lines of many of these protests are disenchanted youths inspired by social media (Florido 2020), anti-colonial politicians like Juan Dalmau, and the music megastar "Bad Bunny" (also Benito Antonio Martínez Ocasio) (2022).

In his most recent album, *Un Verano Sin Ti* (a summer without you), the reggaeton artist comments on the blackouts plaguing the archipelago in the wake of LUMA energy's mismanagement and greed in a track called "El Apagón" (the blackout). Bad Bunny experiences the energy crisis firsthand when he visits the island on tour, the grid being so unreliable that he has to commission diesel generators to supply power to his concert venues. As the track's lyrics indicate, however, "El Apagón" is about more than electricity. When Benito says, "Puerto Rico está bien cabrón," he is simultaneously celebrating and critiquing the colonial conditions of life in the archipelago, where Puerto Ricans live in poverty double that of the poorest state in the United States: Mississippi. The artist goes on to blame the pro-statehood government (PNP) for its role in the LUMA disaster, a prophetic critique given current Governor Pedro Pierluisi's later decision to support the renewal of LUMA's contract (Morales 2022).

When the long-awaited music video dropped, viewers were surprised to find that it included an 18-minute documentary featuring independent journalist Bianca Graulau (2022),

who reports on housing injustices in the archipelago and the accelerating displacement of Puerto Ricans by foreign realtors and cryptocolonists. For Bad Bunny, the blackout is not only electrical, it is also political.

Earthquake damage to buildings near Ponce Data Center, Image: Author

In the aftermath of LUMA Energy's spectacular grid failure, some Puerto Ricans of means kept their lights on, thanks to solar panels or diesel generators, but most households remained without reliable power for months after Hurricane Fiona struck (Laughland 2018). Proponents of the energy company cite the exceptional nature of hurricanes in its defense, claiming it is unrealistic to expect the grid to be more resilient. Meanwhile, many of Puerto Rico's data centers experienced no blackout. Like Bad Bunny's concerts, Puerto Rico's cloud was designed with the electricity grid's unreliability in mind (Taylor 2023). While Puerto Ricans

were in the dark, illuminating their way with candles or flashlights, the cloud thrummed on without so much as a hiccup.

During the pandemic, I conducted ethnographic fieldwork in Puerto Rico's disaster-resilient data centers—digital warehouses brimming with computer servers for local data storage. Despite an upsurge in activity spurred by the coronavirus pandemic (Garriga-López 2020), a horrific bout of earthquakes, and the battering of three major hurricanes in recent years, Puerto Rico's cloud has not experienced any significant downtime (Gonzalez Monserrate 2023).

Data centers are hyper-redundant infrastructures by design (Taylor 2023). Digital capitalism's ceaseless operation is assured by a dizzying chain of fail-safes ready to spring like dominos carefully arrayed in sequence. If the power grid fails, mechanical flywheels transition power to the facility while a fleet of diesel generators rev up from hot standby to full operation. Electricity is always flowing, whether the power grid that energizes the data center is reliable or not. The cloud is always afloat, even if it must guzzle kerosene to keep its lights on.

Data centers in Puerto Rico tend to be located near the coast, where undersea fiber optic cables connect the island into the global net via landing stations in Miami, Barranquilla, and beyond (Starosielski 2015). Given this proximity to the sea, data centers in Puerto Rico are surrounded by towering concrete walls to mitigate the risk of storm surge or tsunamis. The perimeter of these facilities is typically crosshatched with storm drains or cisterns to divert rainwater away from vulnerable electronics.

Sanitization station for hands and feet at data center Entrance, Image: Author

I shadowed technicians in these storm-resistant data centers, accompanying them on their daily routines as they maintained cloud storage services for the archipelago's government, businesses, and residents. I helped them install computer servers into racks, disentangle messy cables, "seed" cables into connection ports, and fiddle with air conditioners to keep servers cold and dry enough to function in the hot and humid Caribbean air.

Mural art in Santurce, Puerto Rico depicting Hurricane Maria, Image: Author

"They called her 'the Mother of God'," technician Raúl Santiago Reyes told me, as we sipped coffee and shared sweet tufts of pan sobao in the breakroom. "I know the names for the hurricanes are randomized every year and there is a list they follow, but you can't help but feel like she was destined to be named María."

As we finished our shift, heaving aging servers onto specialized carts for disposal, I couldn't stop thinking about Raúl's biblical remark. How could something so destructive be named after someone so revered? This juxtaposition of grand creatrix and grand destroyer reminded me of Taíno petroglyphs I spotted along the Río Saliente of Jayuya in Puerto Rico's mountainous interior. For the Taíno, the island's Indigenous people (Feliciano-Santos 2021),

Juracán or the anglicized, "Hurricane", is conceived of as an enraged avatar of the mother deity, Atabey or Attabeira (Schwartz 2015). This furious aspect, known as Guabancex, was said to carve the wind into a spiral with her rage, unleashing the Juracán to punish the wicked, but also to sow the seeds of renewal and regrowth (Schwartz 2015). Guabancex, a revered destroyer and bringer of life, not so unlike Raúl's "Madre de Dios".

Atabey or Attabeira, Supreme Mother Deity of the Taino, Image: Author

"The data centers were the only places on the island that had power," Raúl explained the following week, opening up about his life after María, his face barely visible behind a snug N-95 mask and fogged-up face shield. "So we let the government in, and people from nonprofits, so

they could use the call center to coordinate rescue ops, repairs, and supply runs."

"How did you get back and forth from work?" I asked, uncoiling some ethernet cables.

"I didn't," Raúl started, pulling up photos of the hurricane saved to his device. "They let my family come here. We stayed down here in the breakroom for the first few months until the flooded roads to the mountains were cleared."

"That was kind of them to do," I replied. "Aren't there rules against that sort of thing?"

Raúl nodded, "We take care of our own. They had no other choice."

I listened to Raúl recount how his privately owned and operated data center had become a sanctuary for his family and an unofficial headquarters for state officials and nonprofits scrambling to rebuild and save lives. Or was this yet another layer of digital capitalism's onioning of redundancy? As our shift ended, Raúl and I signed out with security in the spacious lobby. "One more thing that might interest you. This lobby, I convinced the management to open this part up to the public. Normally, we can't for security reasons, but they agreed to open it to people to charge their phones and we set up a public Wi-Fi router for them."

"That's beautiful. I've never heard of a data center doing anything like that."

Raúl gestured to the open space around us, "It was packed in here for weeks. It felt like my congregation back home – our manager was like the pastor. The people were grateful. We gave them a sliver of hope."

I let his story soak in as we ventured out into town for a post-shift beer at a local chinchorro. On an outdoor patio under the shade of coconut palms, we sipped golden-striped cans of Medalla and ate cheese-filled empanadas and chatted about the dark days after Hurricane María. This would not have been possible just a few weeks before when a more extensive coronavirus lockdown was in effect, on the executive order of Wanda Vasquez, the interim governor who succeeded Rosselló after his people-driven resignation (Alvarado León 2019).

After a long while, Raúl leaned forward to ask, "And what about you?"

I scrolled through photos sent to me by relatives and saved on WhatsApp. I told him about my extended family who live in the mountainous part of Guaynabo and how after María

struck, the road was covered in mud, downed power lines, and fallen trees. It took several weeks for the neighbors to band together to get the steep road cleared.

Raúl scratched his chin, "Then you understand. Even though you live in the States, you understand because this is your home as much as Boston is."

I recall feeling disarmed by this remark. We ethnographers like to think we are immune to the gaze we inflict on others in our pursuit of knowledge, even if that pursuit is motivated by a just cause or a desire to help the communities we study. As a Puerto Rican raised in the metropole of the United States, with the privilege of seldom experiencing a blackout and with the right to participate in national elections, I could not help but feel that Raúl was wrong. How could I ever understand? Like so many diasporic Boricuas on the mainland, I worried about my family's safety in the dark months following María and Fiona—but worrying is not the same as living through it.

"I want to," I said carefully. "I want to understand."

A beach across from a Data Center in Isla Verde, Puerto Rico, Image: Author

While hurricanes are a natural condition of life in the Caribbean going back to the pre-colonial Taíno times, climate change is intensifying the frequency and strength of these tropical cyclones (Bhambra and Newell 2022; Keelings and Hernández Ayala 2019; Liboiron 2021). So much of the devastation that followed Hurricane María might have been prevented if the archipelago's infrastructures were better designed to withstand tropical storms (Bonilla 2020). Following from this, Yarimar Bonilla argues that it is "coloniality", not hurricanes that are the disaster in Puerto Rico (2020). While the people of Puerto Rico suffered without electricity or connectivity, the Cloud thrived, immune by design to the dystopia their milieux had become. As argued elsewhere in this dissertation, resilience is a feature rather than a bug of data center design, which readily 'anticipates disaster' (Taylor 2023, p.424). In an 'underground cloud' built in the corpse of a nuclear bunker, A.R.E. Taylor encounters an Ozymandias-like hubris amongst the facility's technicians:

[Bates (a technician)] invited me to knock on the cold concrete walls to 'feel how solid they are', and confidently told me that 'bunkers are built to last, like the pyramids'… the apparent timelessness of bunkers has previously invited comparisons to the enduring megastructures of ancient civilizations…conjuring the durable monuments of the ancient Egyptians, Bates worked with the material-imaginative resonances of the bunker to promote the site as a structure that can withstand not only a nuclear blast, but time itself…this material resistance to time is similarly evoked by the metaphor of 'future-proofing', which draws its rhetorical efficacy from other 'proofing' practices, such as waterproofing and soundproofing, to conjure the future as an almost-material entity (Taylor 2021; p. 86)

While these Cloud bunkers encountered by Taylor might represent a more extreme example of data infrastructure resiliency, the "bunker" logic is pervasive in data centers, that seek to proof themselves out of every would-be calamity, lest it cause downtime and hurt their profits and irreplaceable data. Raúl's data center, modest by comparison to the Bates' concrete monument, successfully kept its lights on after the hurricane struck. Just as crucially, its elaborate system of drains, concrete walls, and slanted roof panels, successfully repelled water that might flood its corridors. The only "tsunami" Raúl had to weather was the surge of data that coincided with global lockdowns, what Pedro Gámez Cersosimo calls, a "tsunami de datos (data tsunami)" (2021, p. 84).

The aftermath of Hurricane Maria, Photo: Laura Adorno Monserrate

If the countermeasures against flooding had failed, Raúl's data center might have ended up like the library at the University of Puerto Rico's Río Piedras campus, "mold-infested", the contents held in the computers irretrievable, a material inevitability when water saturates hard disks (Milagros Rodríguez 2017). Water never breached the "Noah's ark" that Raúl's data center had become (Glanz 2017). Like the data centers in Miami or those based in Houston, after Hurricanes Irma and Harvey struck, Raul's data center continued thrumming along, as if disaster had never occurred (Hogan 2018, p. 632; Glanz 2017). Raúl felt genuinely grateful for the data center housing him and his family during the chaos that María sowed – but he was always part of the plan, another chain in a link of nested redundancies to keep the Cloud operational at all costs.

The Cloud, however, was not always this waterproof. The data centers in Miami, Puerto Rico, and Houston I refer to represent a new disaster-ready generation of facilities, hardened by devastating losses experienced when Hurricane Sandy flooded data centers "taking out diesel fuel pumps used to refuel generators" (Miller 2012). The deluge was elevated to something of a parable used to sow doubt about techno-mastery and redundancy in the industry. Technicians and attendees of industry conferences referred to it as "the mother of all downtime", a strange prelude to Raul's Mother of God remark. The costly spectacle of Sandy drove Jay Parikh, Vice President of Infrastructure at then Facebook, to create a special taskforce called "Operation Storm". Its principal aim was to failure-test Facebook's data centers by running drills and attempting to probe its many layered defenses, should another "superstorm Sandy" appear.

World Without Clouds

In a data center near Boston's wind-whipped seaport, I help Tom "dress" cables. He is grumbling because of the winter weather outside and the refrigerated weather inside, cursing at the tech-in-training whose work we are painstakingly correcting. I study the brightly colored yellow and blue network cables floating freely into the aisle, no longer zip-tied to the metallic cage that keeps them tidy as they snake their way into the back of the servers to provide connectivity. The lights along the server face-plates aren't blinking, which I have learned means there is "no activity". They have yet to go online, which permits us this fiddling in a live environment without fear of disrupting anyone's "services".

"Obviously, I'm still a noob here," I say, carefully undoing the zip-ties bundling the cables together as they descend from the ceiling. "What exactly should this look like?"

Tom turned to me as he pulled the cables taut, "like *waterfalls*." He demonstrated, reclipping and fastening the cables so they looked like multicolored cataracts feeding into the back of the rack. "This mess here is what we call a 'rack's nest'[8]. And no, it's not about looking pretty. There's a method to our madness. If it's sloppy like this it can create problems later on if we have to decommission an asset on this rack. So the key is to keep things neat and *fluid*."

Hydraulic metaphors are commonplace in data centers and the digital worlds they support. There is a watery "poetic" (Hogan 2015, p. 7) that pervades the emic lexicon of the cloud's technicians, everything from Tom's "waterfalls", to 'fluidity' as an aesthetic virtue, and the "ocean" used to describe the thermal gradients gyring on computer screens animated by CFD models:

Google portrays the digital realm as the sea as much as the cloud – and itself as the captain of the ship (Durham Peters 2015, p. 107).

Many data centers today rely on water to cool their servers (Starosielski 2021, p. 210), increasing water's symbolic significance for technicians in their intricate vocational setting that A.R.E. Taylor describes as a "technological wilderness" (2019). Yet, water maintains a kind of paradoxical double life as both the source of "digital life" and what threatens to undo it, as the destructive wet deluge brought on by hurricanes reveal (Hogan 2018). Humidity, the presence of moisture in the air, is a foil to computation, especially in the tropics, as the Singapore case study reveals (Ruamcharoen 2022; Starosielski 2021). Data centers are therefore simultaneously constructed to be water-reliant (Hogan 2015) and water-proof (Taylor 2021, p. 86), hermetically sealed (Ruamcharoen 2022) and thermally permeable (Starosielski 2021). Between wet and dry,

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[8] A.R.E. Taylor documents an alternative lexicon in United Kingdom sited data centers; "cable salad" and "server spaghetti" are the preferred terms there (2019, p.7).

a "ship" (Durham Peters 2015, p. 107) on the verge of becoming a "shipwreck" (Mentz 2015). It is in this interstice where the metaphor of Cloud is drawn:

Air disarranges the boundary between nature and technology, acting as it does as the go-between through which one bleeds into the other (Ruamcharoen 2022, p.2).

A thing of nature, a portent for hydraulic and "thermal shifts" (Starosielski 2021), Cloud serves as a suitable "atmospheric" (Moro 2022) "go-between" for "nature and technology" (Ruamcharoen p.2). Philosopher John Durham Peters defines Cloud as "elemental media", tracing its archaeology back to "kairos", a Greek term connected to weather, which the ancients believed was orchestrated by capricious and wrathful deities (Durham Peters 2015; p. 166). Thousands of years after the Greeks mused on how weather exceeds humankind's control, the Anthropocene troubles this presupposition, reminding us that human agencies can precipitate ecological disasters like Hurricane María. At the same time, total control remains an illusion, even for the most enthusiastic geoengineering proponents (Blackstock and Low 2018), even less so for folks like Tom, whose daily struggle to maintain thermal equilibrium in his data center reveal the ongoing turbulence of *kairos* in the material world.
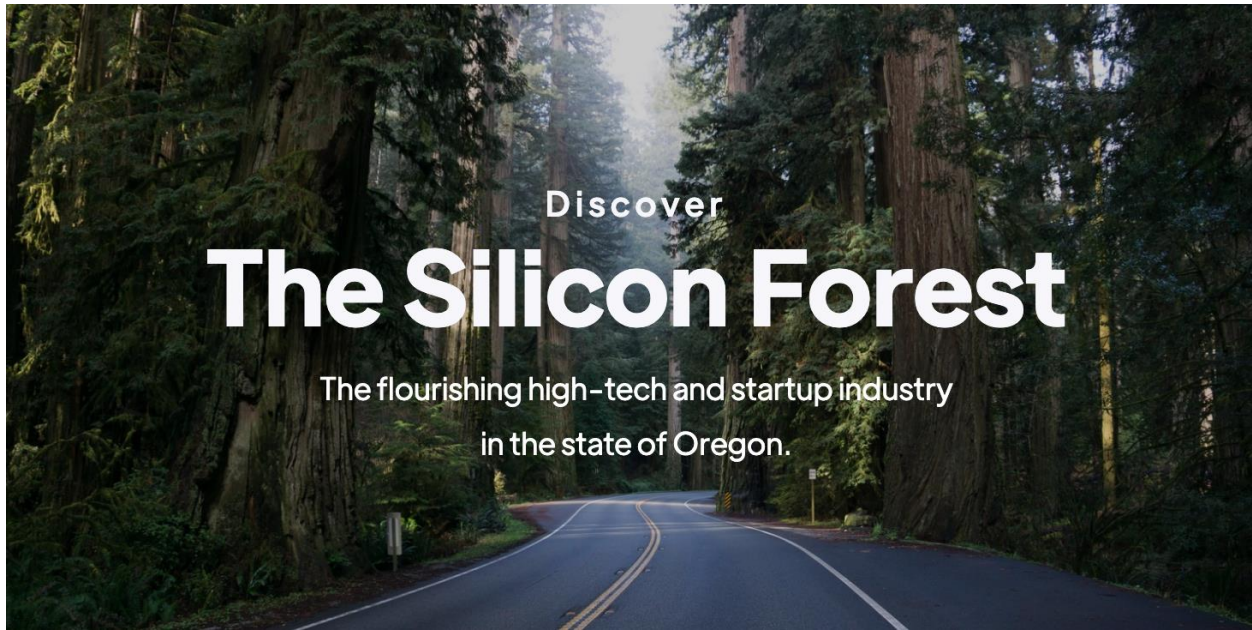
In August of 2011, it rained in the Cloud. At Facebook's Prineville data center, located in the heart of Oregon's "silicon forest" (Levenda and Mahmoudi 2019), an anomalous and catastrophic cooling failure resulted in the formation of a "cloud" inside the facility (Pipkin 2018, p. 4). Caused by an "accidental feedback loop of high temperature and low humidity air from the hot rows entering a water-based evaporative cooling system" (Pipkin 2018, p. 5), this case study is an example of "manmade weather" (Cooper 1998) gone awry. The thermal and hydraulic runaway event documented by Facebook technicians, led to similar conditions of temperature (80°F) and humidity (95%) as the TDC experiment in Singapore. Having failed to partition the "hot" exhaust from the "cold" intake air, the "air returned to the servers on the cold rows…so wet that it condensed" (Pipkin 2018, p. 5). Jay Parikh, then Vice President of Infrastructure Engineering at Facebook, recounted the rare event as follows:

For a few minutes, you could stand in Facebook's data center and hear the pop and fizzle of Facebook's ultra-lean

servers obeying the ultra uncompromising laws of physics (Pipkin 2018, p. 5).

Here, Parikh invokes "the ultra uncompromising laws of physics" as *kairos* (Durham Peters 2015; p. 166), the Nature that "manmade weather" (Cooper 1998) cannot fully "master" in the data center's "wilderness" (Taylor 2019). A postmortem of the event concluded that the failure stemmed from unanticipated consequences of utilizing a new kind of chiller that effective ruptured the "hermetic seal of the server farm" (Pipkin 2018, p. 5; Ruamcharoen 2022). Like the "free cooling" harnessed by circumpolar data centers (Bresnihan and Brodie 2021; Johnson 2023; Vonderau 2019), this Prineville facility, striving for energy efficiency, was "exchanging air with the local climate" by way of "intake and outtake vents" (Pipkin 2018, p. 6). The ship was pocked with holes, a "porosity" (Pipkin 2018, p. 6) that led to "shipwreck" (Mentz 2015):

Like a thunderstorm formed from two opposing weather fronts, the physicality of outside Prineville air met the everywhere-ness of inside space in an impossible, non-Euclidean intersection…although the rain storm was predictable…no one at Facebook saw the cloud coming (Pipkin 2018, p.7).

This dramatic episode of digital "wet shock" (Mentz 2015, p. xxxii), effected changes to Meta's operating guidelines for its data centers; no longer would such high humidity thresholds be tolerated, lest the storm from within recur.

"Peat Slippage in Donegal November 2020" , Donegal Daily TV, Screenshot by Author

Like Oregon, Ireland is known for its cool, wet weather, as the most iconic images of its boggy landscape, roiling with mist reveal. Seduced by these images, lucrative "public incentives" (Bresnihan and Brodie 2023, p. 377), and the promise of "free cooling", data centers are clustering in Ireland, their rapid expansion and energy use resulting in intermittent blackouts (Bresnihan and Brodie 2021; Macauley 2020; McGovern 2020). Sensitive as they are to the carbon footprint of their facilities, companies like Amazon Web Services, TikTok, and Google have constructed wind farms in the island's bog wilderness to offset their emissions and generate energy to feed back into the electricity grids their servers are taxing (Bresnihan and Brodie 2023). Patrick Bresnihan and Patrick Brodie call this conveyor belt like feedback loop of "atmosphere…drawn into the Cloud" for air conditioning and carbon offsetting as the "moebius strip of wind/data" (2021 p.1647). While on paper, renewable energy projects appear to suggest a "progressive arc of green capitalism" (Bresnihan and Brodie 2023, p. 378) pioneered by data center operators, the "extractive logics" (2021, p.1647) at work in Ireland reveal that such pursuits are more about "rationaliz[ing]…ongoing expansions" by repositioning Big Tech as a "custodian and manager of natural resources" (Hogan 2018, p. 632) than reversing course on

climate change. This dynamic became abundantly clear in November of 2020, when Invis Energy's construction of a windfarm to offset Amazon emissions precipitated a literal rather than figurative carbon offset:

A bog collapse…happened at the site of a wind farm under construction at Meenbog, near Ballybofey…a large quantity of peat slid down the hillside and ended up in the Mourne Beg River near Castlederg…a key spawning river for Atlantic salmon – a protected species (Macauley 2020).

The Cloud precipitated another storm, only this one was made of mud, a "peat slippage" that "polluted rivers" (Corr 2020), destabilizing a delicate bog ecology in pursuit of a "global 'future' of eco-modernity" (Bresnihan and Brodie 2023, p. 362).

The Cloud's transformation of Ireland's midland peat bogs does not so much represent a rupture rather than a continuation of capitalist coloniality's extractive history:

The specific waste landscape of peatlands is becoming important to digital infrastructures in historical continuity with older forms of extraction and development. The large-scale, transformative projects of 'smart' and 'green' eco-modernity represented by data centres, wind farms and carbon sequestration evoke discourses from the 18th and 19th centuries, when efforts to drain and reclaim these semi-aqueous territories were driven by moral as well as economic imperatives. These colonial logics and their spatially transformative enactment have endured in how politicians, climate scientists, industrialists and spatial developers alike see bogs as somewhere that must be made valuable for capitalist accumulation at the expense of existing ways of life. (Bresnihan and Brodie 2023, p. 363)

Like the Spaniards' Desagüe (Candiani 2014), the British empire insisted on "draining" and "depleting" the "antiquated" wet ways of life endemic to Ireland's bogs, in order to install their drier version of industrial modernity (Bresnihan and Brodie 2023, p. 363, 377). The Cloud, in partnership with the Irish state, revives this colonial dynamic, repurposing the peat "wasteland" as "pollution sinks for ongoing capitalist activity" (p. 378).Amid these ethnocidal politics,

activists are organizing against data centers, in defense of their way of life and Ireland's

ecological future as data centers continue to flock there, now that the moratorium on construction

has been lifted (McGovern 2020; Ortar et al. 2022). As a keynote speaker for the Consortium of

National University Libraries (CONUL), "Sense and Sustainability" themed conference in Cork,

I chatted with conference goers at a welcome banquet about my research on data centers. Our

conversation abruptly shifted to the peat slides, and one attendee opined that the "Cloud is made

of mud". Another asked me to narrate the origin of the nebulous nickname for digital capitalism

which can be traced back to collaborative early software engineering practices of the 1990s (Hu

2015). The conversation ended, with one attendee declaring that Ireland has many myths about

clouds, "have you ever heard of the Cloud Maker?"

Tandragee Man, Image: Armagh St. Patrick's Cathedral of the Church of Ireland, CC BY-SA 4.0

After some ironic Googling in my hotel room, I quickly discovered the Celtic legend of

Nuada Airgetlám, the First King of Tuatha Dé Danann, his name sometimes translated as "Fog

Bringer" or "Cloud Maker" (Daimler 2016). This discovery, of a mythological hero who

materialized from vapor, wielding it against his foes to carve Ireland out of mud, seeded a

provocative line of thinking about the Cloud's figurative and not so figurative relationship to the clouds.

Following Andrea Ballestero's call for an 'extension of water's materiality' (2015) to include the tangle of material and digital artifacts involved in shaping its future availability, I argue, here that Cloud is Cloud Maker (Daimler 2016) as much as it is Cloud Eater (Benedict 1935). Data centers are part of the "hydrological cycle" (Neilson and Rossiter 2022, p.11); a digital hydraulics that condenses in computational corridors where it falls as rain on servers or outside of them; where the metabolism of carbon offsets unleash muddy flows onto fragile landscapes. Kairos pervades the digital (Durham Peters 2015, p. 120). The Cloud is vaporous; it breathes; it thirsts; it sweats; it is a deluge called Nubecene; both hydrophobe and hydrophage; a cavernous bulwark against the devastating cyclones it helps spring; a series of "metabolic rifts" (Wark 2015) and aqueous exchanges that charter its corrosive expansion; its digital Desagüe sows the colonial mirages of tomorrow's deserts (Candiani 2014, Lehuéde 2022). *This* Cloud is

driving us toward a "World Without Clouds" (Lee et al. 2020) – ruin carved by the torrential

flows of irrigated information. The question that remains is, what comes after this Cloud

dissipates?

Precipitation: AfterCloud

Interstellar Irruption

On December 1ˢᵗ, 2020, I got in my rental car and began my southward descent from the city of Ponce, through a lush landscape speckled with bone-hued karst tors along Puerto Rico's highway 10. I was scheduled to tour the facility's unique data center, which is housed in a Faraday Cage to minimize radio frequency interference or RFI created by computers and other equipment. The radio frequency sensitivity is such that even cell phones can emit enough of a signal to interfere with crucial broadcast equipment involved in research projects like SETI – the Search for Extraterrestrial Intelligence. But as I descended into the karst valley landscape where the facility is housed, I received a phone call informing me that the unthinkable had occurred.

Highway 10 in Puerto Rico, Image: Author

With my Bluetooth active, I jolted with alarm when the person who I was scheduled to meet called me. I wondered anxiously if I had mixed up the appointment time. When I picked up the phone, my

interlocutor, Enrique said:

Enrique: " Me lamento decir que no puedes venir [I regret to say you can't come here]."

Steve: "Podemos cambiar la cita, tengo dia libre – [we can change the appointment time, my day is free]."

Enrique: "No me entiendes, no puedes venir porque se colapsó. [You don't understand, you can't come because the facility has collapsed."

Ruins of the Arecibo Ionosphere Observatory, Image: Author

The collapse of the Arecibo Observatory, long a beacon of international cooperation and research on everything from the atmosphere to extraterrestrial life, was the culmination of decades of infrastructural decay, accelerated by Hurricane Irma, Hurricane Maria, and the 2020 earthquakes that rocked the island's southern coast. In an instant, the facility's interstellar missives stopped sending. If there were aliens listening to us on distant stars, they could hear our signal dissipate into sudden static as the facility collapsed, shaking the foundations of homes within a ten mile radius of the facility.

In 1999, Susan Leigh Starr observed that infrastructure seldom becomes visible until it breaks down. Failure, or breakdown, evaporates the illusion that the infrastructures that we have come to rely on are seamless, automatic, or immaterial. Leigh Starr's observation (1999) feels especially relevant today, an age where the digital is so integrated into the fabric of our lives that we can scarcely imagine life without it. Indeed, were it not for digital applications like ZOOM to facilitate remote participation, the global economy might have collapsed following the outbreak of COVID-19 and the implementation of lockdowns and quarantines across the world. But what does it mean to be reliant on infrastructure that has designed itself to be doomed? How can we not think about what comes after the Cloud, when the Cloud appears to be willfully short-circuiting itself as AI booms and more water, carbon, and electronic waste become enrolled in digital capitalism's metabolism?

The Anthropology playbook has very little to say about fieldsite collapses. If I recall correctly, I started laughing hysterically in the car for a few minutes after Enrique ended the call. The laughter was partially a genuine irony that during a pandemic when it is nearly impossible to do human subjects research, my "backup" field site had quiet literally collapsed. I soon, learned however, that an atmosphere of "colapso" pervaded much of Puerto Rican life, as a colony that has been abandoned by the United States government.

Solar Insurrection

Casa Pueblo in Adjuntas, Photo: Author

Where government fails to sustain infrastructure like the Arecibo observatory, people rise

to the occasion. In the heart of the island's highland interior, hope springs up from a community

garden. There is a spindly tree fashioned from solar panels that has become a symbol of hope and

resistance. This is Casa Pueblo's solar forest in Adjuntas, a case study in liberatory possibility

and a real-world illustration of solarpunk, a utopic, anti-imperial and grassroots-centered genre

of speculative fiction fueled by solar energy (Ulibarri 2022). Casa Pueblo is one of the principal

forces behind Puerto Rico's growing energy independence movement, which the nonprofit's

leader, engineer Alexis Massol González characterizes as "an energy insurrection" (Massol-

González et al. 2008; Glattard et al. 2022). Rather than rely on the privatized energy grid, Casa

Pueblo and other organizations are calling for a solar revolution in Puerto Rico, which would

democratize energy through the creation of microgrids to keep communities powered even after

hurricanes strike or power grids fail (Galluci 2022; Glattard et al. 2022).

A Solar Farm in Puerto Rico, Image: Author

I spoke with technicians at PREPA-operated solar farms along the island's more arid southern coast who are looking to the sun for renewable energy to supplement fossil fuels such as natural gas. While the farms I toured are hampered by limited energy storage capacity and a need to feed electricity back into the fragile national grid, Casa Pueblo's solar insurrectionists hope to liberate the island from grid dependency household by household (Brown 2020; Estrada Torres et al. 2020; Queremos Sol 2022). The tension between these solar farms and the solar microgrids run by residents and nonprofits in the mountains show us that the pervasive blackouts throughout Puerto Rico are not an electrical problem, but a political one, what Dominic Boyer might call *energopolitics* (2019).

Conclusion: Computing's Limit Ecologies

Computers can be found in every continent on Earth, underground, in the sea, and above the sky, where servers have already made the leap into the stars. In 2021, the HPE Spaceborne Computer-2, was installed at the International Space Station to support AI workloads (NASA 2021). Due to zero gravity conditions, radiation, and the quirky physics of vacuum, previous attempts to utilize solid state drives in space failed, until now. What does it mean for the Cloud to extend beyond this world, bringing the Nubecene with it? Bits are terraformers. That is perhaps the principal argument of *Cloud Ecologies*, that computation is "metabolic rift" (Wark 2016) wrought by digital crops and their data farms where information is irrigated, powered, cooled, and repaired by a largely invisibilized, 'masculine' workforce. Lest we risk granting too much agency to bits, electrons, water molecules, and conductive metals (Bennet 2010), it is crucial to define computing's limits as sociomaterial rather than ecological. What makes places hospitable for data centers and the servers they contain cannot be wholly be reduced to "climate" in a geographic sense; these "habitats" for computation have as much to do with political economy (Hogan 2018) and coloniality (Au 2022; Lehuéde 2022) as they do with the harnessing of swaths of the planet as a natural infrastructure or cooling engine for more efficient computation (Carse 2012; Johnson 2019; Hogan 2018; Vonderau 2019).
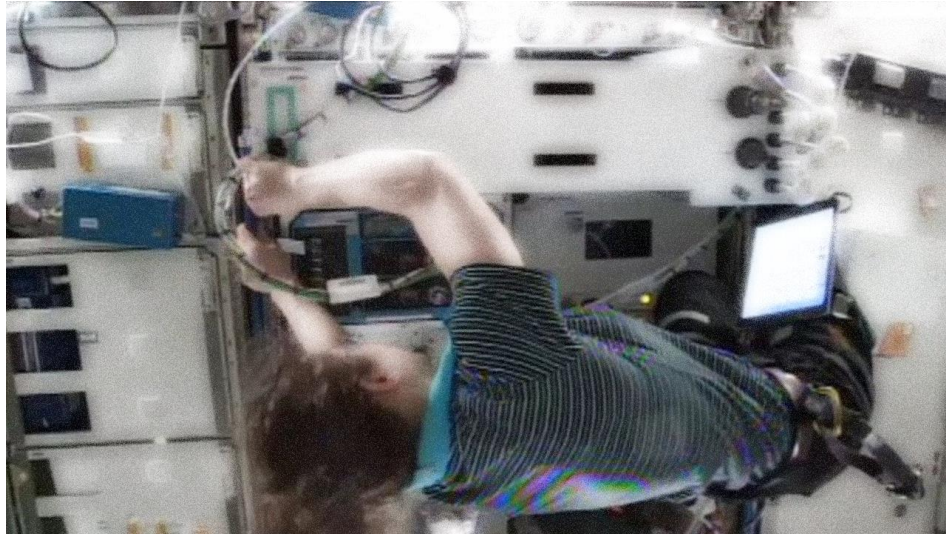
Astronaut Christina Koch at the International Space Station, Image: NASA

Stefan Helmreich introduces *limit biologies* (2011) to describe those peculiar objects of study in the Life Sciences that uneasily straddle the boundary of what is living or not and where life might be found, as is the case of extremophile tube worms residing near deep-sea thermal vents. I offer computing's *limit ecologies*, as a way to think through the sociomaterial consequences of digital capitalism's continued expansion into the final frontiers of the South Pole and now outer space. Is the extreme heat and humidity of Singapore's tropical data centre, an example of this limit ecology, or is that the Mouth in Arizona, where the conditions of workers are so grueling that only short shifts are possible? Is water a limiting factor, as the Cloud continues to expand its hydraulic regime, at the expense of farmers and publics? Is sovereignty a limit to a multinational industry whose infrastructures defy territorial logics (Neilsen and Rossiter 2022)?

I conclude by returning to the YesterCloud where we began. In the Andes, a vast empire thrived using computers made of fabric, a Cloud powered by runners and fibers, rather than

carbon and water. As Anne Pasek reminds us, "digital operations need not be electric" (2023, p.

18), another Cloud is possible.

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