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On Being Anxious About Digital Carbon Emissions

ABSTRACT: This essay examines how many scholars—including myself—are thinking and feeling about growing concerns about the climate impacts of digital networks. Whether in news headlines, civil society reports, or peer presentations, we increasingly encounter alarming figures that link streaming video and cloud storage practices with a potential carbon time bomb. As a result, an eclectic range of personal behaviours have blossomed that seek to acknowledge and respond to these potential harms, including digital land-energy acknowledgements, low-res aesthetics, conspicuous non-consumption, and media arts attempts to prefigure greener futures online. These digital environmental actors may lack a clear account of the relative impacts of a given gesture, but are nevertheless motivated by a strong sense of urgency and responsibility to modify the means by which they communicate online. I have been both a scholar of, and participant in, this panoply of low-carbon digital experiments. In tracing how my thinking has evolved, I seek to provide a self-reflexive assessment of what we might be responding to through these practices and what the role of climate anxiety is or should be in guiding such efforts. While remaining sympathetic to these behavioural shifts, I explore how an emphasis on discrete actions could risk misapprehending the material character of the digital systems we seek to change, overattributing both responsibility and agency to users. I conclude with some evolving criteria for assessing the environmental impacts of digital networks, as well as personal reflections on how the

hermeneutics and practices of infrastructural care provides a productive alternative for thinking and action on the issue.

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Social Media + Society's 2K section provides a rare opportunity to bring readers into the 'back stages' of our research work, exploring the processes, tangents, and doubts that are most often bracketed out of our public facing scholarly communication. When it comes to the climate impacts of digital media, these matters are almost inexorably meta. Those of us working on these questions are often stuck talking about the very digital stages on which we are speaking—all while seeking, perilously, to critique and renovate them at the same time. The results can be both awkward and illuminating. We need *some* ground to stand on, and an audience to stand with, in order to advocate for some potentially quite ambitious goals. The process of securing these conditions has, for me at least, been an experimental one with both its share of missteps and rewards.

Let me start by painting a few scenes. In the first, I'm about to launch into a multi-day online workshop on information and communications technologies (ICT), art, and climate justice. The goal is to bring a group of technologists and media artists together to explore how the arts and tech sectors are currently imbricated—and might be reconfigured in future—as part of a wider decarbonization plan made for and by art

workers.[1] My job is to summarize and organize months of research from a winding set of empirical and interpretive fields. I have an extensive set of infographics and statistics to share, detailing the carbon footprint of everything from sending an email (as little as 4 grams (Richards, 2018)) to running the entire bitcoin network (up to 46.72 Mt/year—equivalent to the nation of Finland (*Bitcoin Energy Consumption Index*, n.d.). The ICT sector's climate emissions are, I will soon urge, an urgent problem. Effectively addressing them will mean disrupting the aesthetic and operational norms of some of the largest corporations on earth.

But first: a self-reflexive gesture. In addition to the usual land acknowledgement (a ritual common to us in Canada that details the treaties and First Nations of the territories on which we are gathered) I also attempt to chart the digital and energy infrastructures involved in our transatlantic Zoom call. Here, I show, are the Equinix data centers, the power plants, uranium mines, and unanswered environmental harms that play a role in our meeting today. Let's acknowledge them too. We are all meeting and living inside the frame of the problem.

I probably don't do a terribly good job of the whole thing; I run a little long and overly didactic with an audience I've only just met. At the end, a participant jokes that, if Zoom isn't as green as we thought, maybe we shouldn't be meeting at all. I laugh and grimace at the same time. I can see how the joke defuses some of the tension I've built, even though it isn't the conclusion any of us particularly want to come to.

[1] You can read the results of this process at https://sunlightdoesntneedapipeline.com/2022/08/17/digital-decarbonisation-consensus-conjectures/.

A year prior, I'm running an online lecture series with a network of scholars I've invited to think with me about the climate impacts of our research methods.[2] Again, I get out ahead of myself and the speakers. I suggest that, in light of the problem of sprawling data centers, there is a need for mitigating actions right here in our virtual room. These are in part social: I urge my participants to turn off their video when they aren't talking, stressing how this will "reduce the carbon intensity of the endeavour." Others are more personal and infrastructural: I will later take the video recording (stored *locally*, not on the cloud) and compress it to near oblivion in order to make it small enough to fit onto an SD card loaded in a raspberry pi powered by a solar panel in my backyard. This low-tech, low-energy server is itself an experiment (or provocation?) in climate-conscious digital research infrastructure (Brain et al., 2022). There will be insights to be had, I hope, by trying to operate within its stubborn constraints: no YouTube, no institutional repository, no placeless cornucopia of computing (Abbing, 2021). Instead, I have just 64 GB of space and a very variable and weather-dependent amount of uptime. Even so, the boundaries of what this set up allows aren't totally clear to me yet, so I insist on the most visually and data austere approach. I compress the video another time. The blaringly large pixels, I hope, will signify.

I am in these moments, I know, being a little weird—maybe also a little extra. I am trying to achieve both pragmatic and constitutive ends: to in some small way reduce the carbon footprint of our online gatherings, and to also frame this question as a problem worthy of individual experiment and collective concern. I might also simply be annoying. Some colleagues have asked me for my slides and scripts around these moments of

[2] You can find us at http://lowcarbonmethods.com/, at least when our server is up.

digital acknowledgement so that they can mirror—or at least contemplate—these communicative moves. Others, no doubt, happily shuffle on to the next Zoom talk where the social rituals of speaking and listening online are much simpler.

Weird though I am, I am not alone. There are a growing number of us out there compelled towards these experiments with and critiques of our means of digital communication. I know of colleagues slipping notes into their syllabi detailing the human and climate costs of cloud streaming (Hilderbrand, 2020). Others have launched climate-conscious digital film festivals (Marks & Przedpełski, 2021), Mastodon instances (Laser et al., 2022), and websites (De Decker, 2019; Landa, 2021), all with demonstrably different material and aesthetic modes of sensing and shifting our data-energy relations. Together we seem to be caught up in something quite similar to what Hannah Knox observes in her study of climate scientists and civic activists: climate is not an external and static problem here, but rather one in which our thoughts, gestures, and methods are thoroughly entangled (and signifying!) within the fields we're trying to study (Knox, 2020). The results can be a little noisy and self-referential. The backstage and frontstage distinction gets burry.

This impulse to do something, even just to place ourselves inside the physical movements of the problems we study, seems in part a logical extension of the material turn that's winding its way through our many allied fields. More and more colleagues are thinking through the economic and environmental impacts of communication by way of the watersheds, coal ash, and dissipating heat imbricated in the data centres that power the Internet and its many clouds (Hogan, 2015; Pasek, 2019; Velkova, 2016). This requires an orientation towards the infrastructural—stuff that you can kick, as Lisa Parks

aptly summarizes (Parks, 2014). It can also be rather depressing reading, with far more problems than solutions mustering across our warming world. It makes sense that, after stewing in it all long enough, you might want to actually kick something.

This points to the unignorably emotional aspect of doing this work: we all seem to carry a fair bit of anxiety with us (or at least, I certainly do). This is common enough to climate work in general. The vast asymmetries between the scales of action we need to prevent future immiserations and the state of these efforts in the present can be a little maddening. The seeming apathy of others and inertia of our social arrangements is a further source of agitation (Ray, 2020). The meteoric rise of video conferencing during the past three years, combined with the sundry stresses and loneliness of the pandemic, surely deepened this angst just as it raised the stakes of the problem.

And so I wonder if the ethos of acknowledgement that runs across so many of these digital decarbonization gestures is, to at least some small degree, also a bit of a bid for social recognition. Could our communication be, in some small part, phatic? Are we looking for others to affirm that, yes, we see your concern—we are also anxious? I'd be lying if I said that this wasn't at play in some level of my many such experiments.

My feelings on these practices have grown more complicated over time. On the one hand, certainly worse bids for attention have been made in the strange social milieu of academia. Even so, I fear that there are some potential hazards at play here. Beyond merely annoying my audience, I might also mislead them.

This is at once an empirical question; if I only kick at the closest parts of the entwined digital and climate systems at hand, I won't present a very accurate depiction of their total shapes. The quantitative research on the environmental impacts of ICT is

less certain than some communications researchers have presumed and it isn't terribly well captured by attempts to measure discrete, individual actions (Pasek et al., 2023). My injunction that my Zoom audience should turn off their cameras, for instance, ignores the fact that the carbon intensity of digital streaming doesn't neatly scale with the amount of data passing through network infrastructures. Transmission equipment, data centres, ISP operations, and home routers are more or less always on, drawing the same amount of electricity regardless of consumer use (Ericsson IndustryLab, 2020). Our gesture, ultimately, probably didn't achieve that much. I was incorrect to presume (and instruct!) that it did.

A further risk lies in how these statements configure the terms of apprehensible political work. Here the trap, as always, is to assume that individual consumer behaviours are the best or only starting place for environmental politics. It's a tale as old as (white) environmentalism, and it's an enduring barrier to building the coalitions and emotional resilience we'll need to take on both big oil and big tech. The on-the-ground fight against data infrastructures and their energy demands (Bresnihan & Brodie, 2020) are much more exciting than I am when I nag you to store less files in the cloud.

That all said, I am not abandoning my material and social experiments in low-carbon digital communications, nor do I want to suggest that the sum of such efforts has been negative. Instead, I've come to see the value of these practices in the emotional and epistemic dividends they offer, beyond a narrow accounting of avoided emissions. Building experimental infrastructure has been good for me: it's forced a rapid education in the mechanics of Linux command line, html coding, and server configurations, and thus brought me closer to the material and mechanical stuff of computation. These

lessons bring pragmatic optimism to my questions about how digital networks could be otherwise configured (Lison, 2022). At times I find myself wondering if this could be an infrastructural equivalent to the civic upskilling effects of volunteer social media moderation (Zuckerman, 2022). Perhaps these are classrooms for many future, undetermined ends. At other moments, I'm content to simply have small rituals of care I can offer up to a burning world: brushing snow off a solar panel, updating my DNS information after a prolonged period offline, or dithering another image. To quote a fellow traveler in the world of solar-powered websites, "the practical elements give me more joy than when merely focusing on theory" (Landa, 2021). Joy is, I think, worth building into our research methods.

But what should we ultimately do about the climate impacts of digital media? My answer to my workshop participants last fall, and my answer to you today, is that there are many directions to explore: none definitive, yet some with more to offer than others. I've personally found clarity in Mél Hogan's concept of the 'data center industrial complex,' which argues that the drivers of ICT expansion are more reifying assumptions about the need for growth than discrete consumer behaviours in and of themselves (Hogan, 2021, p. 284). This helps me to ask new questions: what can we do to prevent the next data center from being built? How might degrowth provide a hermeneutic for digital communication systems built around equity, rather than green austerity (Abbing, 2021)? The move here from anxious acknowledgment to material practice is a sustaining one.

References

Abbing, R. R. (2021). 'This is a solar-powered website, which means it sometimes goes offline': A design inquiry into degrowth and ICT. *LIMITS: Workshop on Computing within Limits*. https://doi.org/10.21428/bf6fb269.e78d19f6

Bitcoin Energy Consumption Index. (n.d.). Digiconomist. Retrieved February 3, 2023, from https://digiconomist.net/bitcoin-energy-consumption/

Brain, T., Nathanson, A., & Piantella, B. (2022). Solar Protocol: Exploring Energy-Centered Design. *Eighth Workshop on Computing within Limits 2022*, 7. https://computingwithinlimits.org/2022/papers/limits22-final-Brain.pdf

Bresnihan, P., & Brodie, P. (2020). New extractive frontiers in Ireland and the moebius strip of wind/data. *Environment and Planning E: Nature and Space*, 2514848620970121. https://doi.org/10.1177/2514848620970121

De Decker, K. (2019, July 17). *Solar Powered Website Design*. LOW←TECH MAGAZINE. https://solar.lowtechmagazine.com

Ericsson IndustryLab. (2020, February 4). *Digital carbon footprint*. Ericsson. https://www.ericsson.com/en/news/2020/1/digital-carbon-footprint

Hilderbrand, L. (2020). Cinema and Media Pedagogy in the Streaming Era. *Media+Environment*, *2*(1). https://doi.org/10.1525/001c.17242

Hogan, M. (2015). Data flows and water woes: The Utah Data Center. *Big Data & Society*, *2*(2), 1–12. http://journals.sagepub.com/doi/abs/10.1177/2053951715592429

Hogan, M. (2021). The Data Center Industrial Complex. In M. Jue & R. Ruiz (Eds.), *Saturation an elemental politics* (pp. 283–305). Duke University Press.

Knox, H. (2020). *Thinking like a climate: Governing a city in times of environmental change*. Duke University Press.

Landa, L. (2021, August 21). Ecological Thought and Digital Technology What can be learned by following a “hands-on” approach to sustainable IT? *ETHOS Lab*. https://ethos.itu.dk/ecological-thought-and-digital-technology-what-can-be-learned-by-following-a-hands-on-approach-to-sustainable-it/

Laser, S., Pasek, A., Sørensen, E., Hogan, M., Ojala, M., Fehrenbacher, J., Hepach, M., Celik, L., & Ravi Kumar, K. (2022). The environmental footprint of social media hosting: Tinkering with Mastodon. *EASST*, *41*(3). https://www.easst.net/article/the-environmental-footprint-of-social-media-hosting-tinkering-with-mastodon/

Lison, A. (2022). Minimal Computing. *Counter-N*. https://doi.org/10.18452/25607

Marks, L. U., & Przedpełski, R. (2021, April 13). Bandwidth Imperialism and Small-File Media. *Post45*. https://post45.org/2021/04/bandwidth-imperialism-and-small-file-media/

Parks, L. (2014). Stuff You Can Kick: Toward a Theory of Media Infrastructure. In D. T. Goldberg & P. Svensson (Eds.), *Humanities and the Digital* (pp. 355–373). MIT Press.

Pasek, A. (2019). Managing Carbon and Data Flows: Fungible Forms of Mediation in the Cloud. *Culture Machine*, *18*. http://culturemachine.net/vol-18-the-nature-of-data-centers/managing-carbon/

Pasek, A., Vaughan, H., & Starosielski, N. (2023). The World Wide Web of Carbon: Towards a Relational Footprinting of ICT's Climate Impacts. *Big Data & Society*, *In Press*.

Ray, S. J. (2020). *A field guide to climate anxiety: How to keep your cool on a warming planet*. University of California Press. https://www.degruyter.com/isbn/9780520974722

Richards, L. (2018, February 23). *The Carbon Cost of an Email—The Carbon Literacy Project*. The Carbon Literacy Project. https://carbonliteracy.com/the-carbon-cost-of-an-email-2/

Velkova, J. (2016). Data that warms: Waste heat, infrastructural convergence and the computation traffic commodity. *Big Data & Society*, *3*(2).

Zuckerman, E. (2022). How social media could teach us to be better citizens. *Journal of E-Learning and Knowledge Society*, *18*(3), 36–41. https://doi.org/10.20368/1971-8829/1135818