COMM 330
Clouds, Cables, and Broken Things:
Investigating Internet Infrastructure

M/W 11:00-12:30
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Racks upon racks of hot, humming boxes, tangles of threaded glass stretched across the globe, and thousands of people laboring to keep it all duct-taped together so that we can share cat videos and binge Tiger King on Netflix. What exactly *is* the Internet anyway? How do we make sense of it? Where do we even start? This course will bring the Cloud down to Earth, exploring the Internet through its material footprint, and introducing students to the field of Critical Infrastructure Studies. We will dive headlong into the deep materiality of the Internet, with an emphasis on the history, geography, and politics of its infrastructure(s). Students will learn how the Internet works, how information moves, who moves it, and how it works through, within, and between other built infrastructures, past and present.

The course is divided into four modules: *Ground-work*, *Forms*, *Processes*, and *Residuals*. *Ground-work* lays the foundation (the infrastructure, if you will) for the course. Students will learn how scholars define and deploy concepts of infrastructure, and how these concepts are used to study the Internet. *Forms* explores the Internet through its infrastructural objects. Students will learn how to conduct humanistic infrastructural analyses of the clouds, cables, and data centers that give the Internet form. But what does it take to maintain this form? *Processes* follows the stuff of the Internet as it travels from dirt to data, with a focus on mining, logistics, and energy. Students will learn how these processes help bind the Internet together. Lastly, *Residuals* deals with conflicting concepts of waste (e-waste, mining waste, manufacturing waste, from all links in the supply chain), and the monumental amount of human labor involved in repairing, maintaining, and caring for the material forms, processes, and imaginaries that uphold digital life.

Course Materials
No need to buy books! All readings will be available on Canvas.

Assignments

The Big Ones

1. Midterm: *Infrastructural Map of a Technical Object* (**15% of your grade)**
   For this assignment you will choose a technical object (like a smartphone, a pair of headphones, an instrument, a lightbulb, or even a book) and produce as comprehensive a map as you can of its infrastructure—all the stuff/people/work/energy needed for this object to exist and function. Think hard, and think far. This map can take a variety of forms. You can write a descriptive essay, produce a video, make an audio project, design a literal map, create data visualizations, or other forms I haven't yet imagined! The only restrictions are that it must be considered, detailed, and reference class discussions and readings. **This assignment**

will be due at the end of week seven, and you will consult with me about your idea and format at the beginning of week four.

2. Final: *Infrastructural Portfolio of a Technical Object* (**50% of your grade)**
   You will use the map you produced in the first half of the course to expand your analysis into an *infrastructural portfolio*, which will contain not only your map, but also critical reflections (5-7 pages) on why you chose to describe and frame your object the way you did. What does your map add to our knowledge of this object? Why is it important? This portfolio must also contain at least two additional modes of analysis different from your map. The intent of this assignment is to see the infrastructure(s) of your object(s) from multiple perspectives, using multiple media. For example, if your map was a descriptive essay, your final portfolio should include visual, audio, or design components in addition to your final written analysis. This content can take a multitude of forms (including making a zine, collecting and displaying archival materials, or even a series of Tik Toks that address the infrastructure(s) of your object(s) in various ways). These are merely my ideas. I'm sure you have better ones! But you must find a way to collect and connect all your work into a cohesive portfolio that makes sense as a whole. **This assignment will be due at the end of the last week of class, and you will consult with me on your ideas and plans for your final *infrastructural portfolio* by the end of week eleven.**

The Other Stuff

1. Class Participation (**10% of your grade**)
   This is a reading-heavy seminar-style course, and as such, it is expected that we will all engage equally in spirited discussions. I will not be counting participation points or anything of that nature, as I know everyone's participation style differs, but come ready and prepared to learn together with peers.
2. Discussion Leading (**15% of your grade**)
   Each student will choose one session to lead this semester. You will frame our class for the day, identify key themes and topics from the readings, and moderate our discussion.
3. Participation in Class Slack Discussion (**10% of your grade**)
   In lieu of a weekly discussion board, I would like to inject the chaos of the group chat into this class. On our class Slack anyone can pose questions about the readings, or interesting thoughts about the topics we cover. This Slack should act as an extension of our in-class discussions, and will hopefully lead to some robust, collaborative ideas. Again, I will not be keeping track of points or anything of that nature, but I expect you to be engaged. I want to hear your ideas/questions, whatever form they take. The Slack is for these kernels of ideas, perhaps unfinished, perhaps not even complete sentences yet.

CLASS SCHEDULE

Ground-Work

Week One

- Session One: Introductions, ice-breakers, syllabus, etc.

- Session Two: What is *infrastructure*?—Opening gambits
  - o READINGS:
    - Anand, N., Gupta, A., & Appel, H. (Eds.). (2018). *The Promise of Infrastructure*. Duke University Press. (Introduction)
    - Star, S. L. (1999). The Ethnography of Infrastructure. *American Behavioral Scientist*, *43*(3), 377–391. https://doi.org/10.1177/00027649921955326

Week Two
- Session Three What is *infrastructure*?—On people and dirt
  - o READINGS
    - Young, L. C. (2017). Innis's Infrastructure. *Cultural Politics an International Journal*, *13*(2), 227–249. https://doi.org/10.1215/17432197-4129161
    - Simone, A. M. (2004). People as Infrastructure: Intersecting Fragments in Johannesburg. *Public Culture*, 24.

- Session Four: Infrastructure and/as violence
  - o READINGS
    - Brown, I. J., & Moafi, S. (2021). *Environmental Racism In Death Alley, Louisiana*. Forensic Architecture. https://forensic-architecture.org/investigation/environmental-racism-in-death-alley-louisiana
      - (WATCH ALL VIDEOS AND READ ABOUT METHODS)
    - Sherman, Z. (2021). Infrastructures and the Ontological Question of Race. *E-Flux Architecture*, *Coloniality of Infrastructure*. https://www.e-flux.com/architecture/coloniality-infrastructure/411239/infrastructures-and-the-ontological-question-of-race/

Week Three
- Session Five: Prehistories of the Internet—Eco(techno)logies
  - o READING
    - Tully, J. (2009). A Victorian Ecological Disaster: Imperialism, the Telegraph, and Gutta-Percha. *Journal of World History*, *20*(4), 559–579.
    - Ensmenger, N. (2018). The Environmental History of Computing. *Technology and Culture*, *59*(4S), S7–S33. https://doi.org/10.1353/tech.2018.0148

- Session Six: Prehistories of the Internet—On standards
  - o READINGS
    - Abbate, J. (1999). *Inventing the internet*. MIT Press. (Chapter 1)
    - Burrington, I. (2019, October 29). How We Misremember the Internet's Origins. *The New Republic*. https://newrepublic.com/article/155532/misremember-internets-origins

Forms

Week Four <mark>(CONSULT WITH ME THIS WEEK ON YOUR TECHNICAL OBJECT)</mark>
- Session Seven: Cables
  - READINGS
    - Starosielski, N. (2015). *The Undersea Network*. Duke University Press. (Introduction)
    - Halegoua, G. R., & Lingel, J. (2018). Lit up and left dark: Failures of imagination in urban broadband networks. *New Media & Society*, *20*(12), 4634–4652. https://doi.org/10.1177/1461444818779593
    - IN-CLASS SCREENING: *The Land of Wandering Souls* (dir. Rithy Panh)

- Session Eight: Data Centers
  - READINGS
    - Hogan, M. (2021). The data center industrial complex. In *Saturation: An elemental politics*. Duke University Press. pp. 283-305.
    - Johnson, A. (2019). Emplacing Data Within Imperial Histories: Imagining Iceland as Data Centers' 'Natural' Home – Alix Johnson. *Culture Machine*. https://culturemachine.net/vol-18-the-nature-of-data-centers/emplacing-data/

Week Five
- Session Nine: Cloud—on seeing
  - READINGS
    - Mattern, S. (2016). Cloud and Field. *Places Journal*. https://doi.org/10.22269/160802
    - Carruth, A. (2014). The Digital Cloud and the Micropolitics of Energy. *Public Culture*, *26*(2 73), 339–364. https://doi.org/10.1215/08992363-2392093

- Session Ten: Clúd (earth)—on walking
  - READINGS
    - Winthereik, B. R., Maguire, J., & Watts, L. (2019). The Energy Walk Infrastructuring the Imagination. In J. Vertesi & D. Ribes (Eds.), *DigitalSTS: A Field Guide for Science & Technology Studies* (pp. 349-363). Princeton University Press. https://digitalsts.net/wp-content/uploads/2019/03/22_The-Energy-Walk.pdf
    - (SKIM) Burrington, I. (2016). *Networks of New York: An illustrated field guide to urban internet infrastructure*. Melville House.
  - CLASS EXCURSION TO EXCAVATE AND RECORD INTERNET INFRASTRUCTURE ON CAMPUS

Week Six
- Session Eleven: Internet Governance
  - READINGS
    - Rosa, F. R. (2021). Internet interconnection infrastructure: Lessons from the global South. *Internet Policy Review*, *10*(4). https://doi.org/10.14763/2021.4.1583

- Mueller, M. (2015). *Roadmap for globalizing IANA: Four principles and a proposal for reform*. Internet Governance Project. https://www.internetgovernance.org/wp-content/uploads/ICANNreformglobalizingIANAfinal.pdf

- Session Twelve: Platforms and Digital Closure
  - READINGS
    - Plantin, J.-C., Lagoze, C., Edwards, P. N., & Sandvig, C. (2016). Infrastructure studies meet platform studies in the age of Google and Facebook. *New Media & Society*, *20*(1), 293–310. https://doi.org/10.1177/1461444816661553
    - Markham, A. (2020). The limits of the imaginary: Challenges to intervening in future speculations of memory, data, and algorithms. *New Media & Society*, 146144482092932. https://doi.org/10.1177/1461444820929322

Week Seven
- Session Thirteen: Users, Intended or Otherwise
  - READINGS
    - Parks, L. (2015). Water, energy, access: Materializing the internet in rural Zambia. In L. Parks & N. Starosielski (Eds.), *Signal Traffic: Critical Studies of Media Infrastructures*. (pp. 115-136). University of Illinois Press.
    - Bridges, L. E. (2021). Digital failure: Unbecoming the "good" data subject through entropic, fugitive, and queer data. *Big Data & Society*. https://doi.org/10.1177/2053951720977882

- Session Fourteen
  - NO READINGS
    - Student presentations of infrastructural maps of technical objects

INFRASTRUCTURAL MAP OF A TECHNICAL OBJECT ASSIGNMENT DUE AT THE END OF THE WEEK

Processes

Week Eight
- Session Fifteen: Media Geology
  - READINGS
    - Parikka, J. (2016). *A Geology of Media*. University of Minnesota Press. (selections)
    - Yusoff, K. (2018). *A Billion Black Anthropocenes or None*. University of Minnesota Press. (Chapter 1)

- Session Sixteen: On Mining
  - READINGS

- Arboleda, M. (2020). *Planetary Mine: Territories of Extraction Under Late Capitalism*. Verso. (Introduction)
- Klinger, J. M. (2017). *Rare Earth Frontiers: From Terrestrial Subsoils to Lunar Landscapes*. Cornell University Press. (Introduction)

Week Nine
- Session Seventeen: Logistics and other media mobilities
  - READINGS
    - Tsing, A. (2009). Supply Chains and the Human Condition. *Rethinking Marxism*, *21*(2), 148–176. https://doi.org/10.1080/08935690902743088
    - Posner, M. (2021). Breakpoints and Black Boxes: Information in Global Supply Chains. *Postmodern Culture*, *31*(3). http://muse.jhu.edu/article/835830

- Session Eighteen: Data peripheries—Thinking with/on outsides
  - READINGS
    - Cooper, Z. G. T. (2021). Of dog kennels, magnets, and hard drives: Dealing with Big Data peripheries. *Big Data & Society*, *8*(2). https://doi.org/10.1177/20539517211015430
    - Hockenberry, M. (2021). Redirected entanglements in the digital supply chain. *Cultural Studies*, 1–22. https://doi.org/10.1080/09502386.2021.1895242

Week Ten
- Session Nineteen: What is *Energy*?
  - READINGS
    - Boyer, D. (2014). Energopower: An Introduction. *Anthropological Quarterly*, *87*(2), 309–334.
    - Prigogine, I., & Stengers, I. (1984). *Order Out of Chaos: Man's New Dialogue with Nature*. Verso. (Chapter 4)

- Session Twenty: Energy and/as data—Bitcoin, NFTs, and other proofs of work
  - READINGS
    - Lally, N., Kay, K., & Thatcher, J. (2019). Computational parasites and hydropower: A political ecology of Bitcoin mining on the Columbia River. *Environment and Planning E: Nature and Space*, 251484861986760. https://doi.org/10.1177/2514848619867608
    - Taylor, M. B. (2017). The Evolution of Bitcoin Hardware. *Computer*, *50*(9), 58–66. https://doi.org/10.1109/MC.2017.3571056
    - Seal, M. (2019, November 4). *The Big Bitcoin Heist*. Vanity Fair. https://www.vanityfair.com/news/2019/11/the-big-bitcoin-heist

Week Eleven
- Session Twenty One: A.I. and other "machine learners"
  - Mackenzie, A. (2017). *Machine Learners: Archaeology of a Data Practice*. MIT Press. (Introduction)
  - AI Now Institute. (2019, October 17). AI and Climate Change: How they're connected, and what we can do about it. *Medium*.

https://medium.com/@AINowInstitute/ai-and-climate-change-how-theyre-connected-and-what-we-can-do-about-it-6aa8d0f5b32c
- o Crawford, K., & Joler, V. (2018). *Anatomy of an AI System.* Anatomy of an AI System. Retrieved January 1, 2020, from http://www.anatomyof.ai (EXPLORE MAP, SKIM ESSAY)

- Session Twenty Two: NO CLASS
  - o MAKE APPOINTMENTS WITH ME TO DISCUSS YOUR FINAL PORTFOLIOS

Residuals

Week Twelve
- Session Twenty-One: Carbon and the Internet
  - o READINGS
    - Pasek, A. (2019). Seeing Carbon Through Silicon. *Logic Magazine*, *9*. https://logicmag.io/nature/seeing-carbon-through-silicon/
    - Daggett, C. (2018). Petro-masculinity: Fossil Fuels and Authoritarian Desire. *Millennium: Journal of International Studies*, *47*(1), 25–44. https://doi.org/10.1177/0305829818775817
- Session Twenty-Two: What is a "footprint" anyway?
  - o READINGS
    - Gupta, U., Kim, Y. G., Lee, S., Tse, J., Lee, H.-H. S., Wei, G.-Y., Brooks, D., & Wu, C.-J. (2021). Chasing Carbon: The Elusive Environmental Footprint of Computing. *2021 IEEE International Symposium on High-Performance Computer Architecture (HPCA)*, 854–867. https://doi.org/10.1109/HPCA51647.2021.00076
    - Velkova, J. (2021). Thermopolitics of data: Cloud infrastructures and energy futures. *Cultural Studies*, *35*(4–5), 663–683. https://doi.org/10.1080/09502386.2021.1895243

Week Thirteen
- Session Twenty-Three: Waste, e- and otherwise
  - o READINGS
    - Lepawsky, J. (2018). *Reassembling Rubbish: Worlding Electronic Waste.* MIT Press. (Chapter 6)
    - Liboinon, M. (2021). *Pollution is Colonialism.* Duke University Press. (Selections)
    - IN-CLASS ACTIVITY: We will dismantle broken hard drives by hand and attempt to separate the recyclable and recoverable components.

- Session Twenty-Four: Invisible Waste and Slow Violence
  - o READINGS
    - Nixon, R. (2011). *Slow Violence and the Environmentalism of the Poor.* Harvard University Press. (Selections)

- Ishida, M. (2016). The lack of media: The invisible domain post 3.11. In J. Walker & S. Starosielski (Eds.), *Sustainable Media: Critical Approaches to Media & Environment.* Routledge

Week Fourteen
- Session Twenty-Four: Waste in context—South Greenland
  - READINGS
    - WATCH *White Paper* (dir. Paninnguaq Lind Jensen and David Heilmann Ottossen) https://www.youtube.com/watch?v=TWJ3JOnt3-I
    - Nuttall, M. (2013). Zero-tolerance, uranium and Greenland's mining future. *The Polar Journal.* No. 3(2). (pp. 368-383).
- Session Twenty-Five: Maintenance and Repair
  - READINGS
    - Mattern, S. (2018). Maintenance and Care. *Places Journal.* https://placesjournal.org/article/maintenance-and-care/
    - Jackson, S. J. (2014). Rethinking Repair. In T. Gillespie, P. Boczkowski, & K. Foot (Eds.), *Media Technologies: Essays on Communication, Materiality and Society.* MIT Press.
    - Stuelke, P. R. (2021). *The ruse of repair: US neoliberal empire and the turn from critique.* Duke University Press. (Conclusion)

Week Fifteen
- Session Twenty-Six: Student Presentations
  - NO READINGS
- Session Twenty-Seven: Student Presentations
  - NO READINGS

FINAL PORTFOLIOS DUE AT THE END OF THE WEEK

THE END (SAD!)