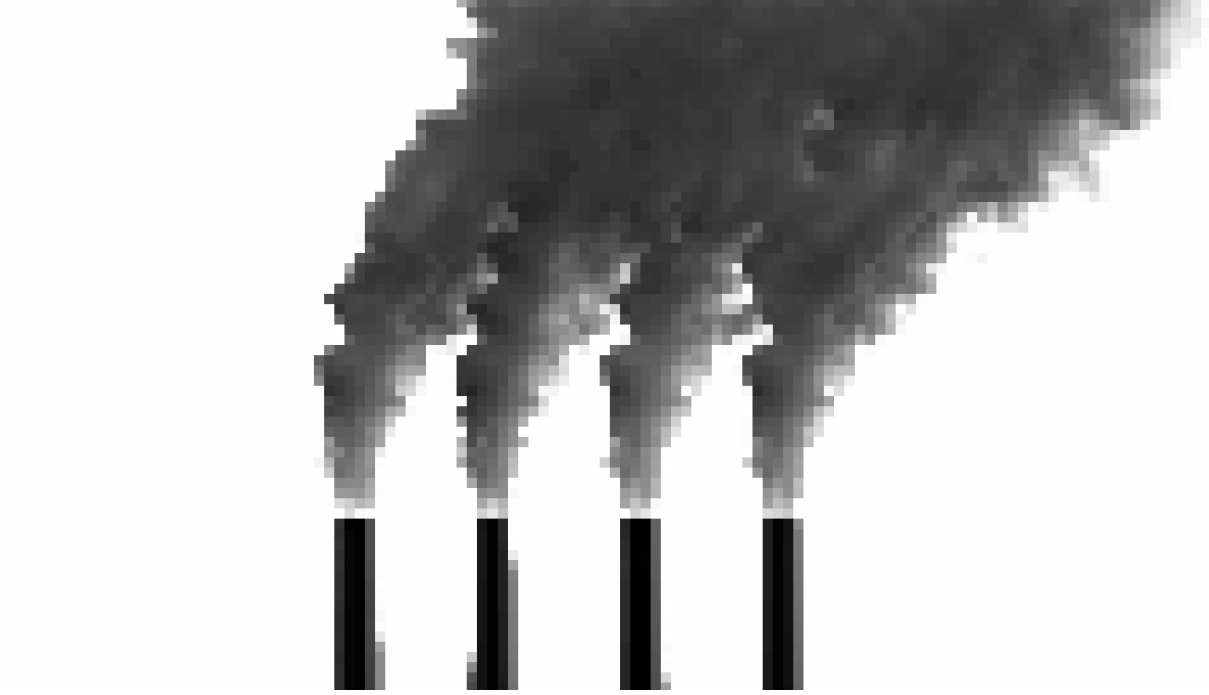

Computing and the Environment

Computing, Culture, and Society Seminar

INFO I-609 • Fall 2018

One of the more persistent and popular explanations of why the modern "Information Age" is so radically different from other eras in the history of technology has to do with the perceived immateriality of information technology. Whereas other technological revolutions were so clearly associated with the production of physical artifacts and the consumption of material resources, the electronic digital computer is often seen as a low-impact, environmentally-friendly, and increasingly "invisible" (or at least microscopic) technology.

In this seminar we will explore the multiple ways in which humans, environment, and computing technology have been in interaction over the past several centuries. From Charles Babbage's Difference Engine (a product of an increasingly global British maritime empire) to Herman Hollerith's tabulating machine (designed to solve the problem of "seeing like a state" in the newly trans-continental American Republic) to the emergence of the ecological sciences and the modern petrochemical industry, information technologies have always been closely associated with the human desire to understand and manipulate their physical environment. More recently, humankind has started to realize the environmental impacts of information technology, including not only the toxic byproducts associated with their production, but also the polluting effects of the massive amounts of energy and water required by data centers at Google and Facebook (whose physicality is conveniently and deliberately camouflaged behind the disembodied, ethereal "cloud").

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Course Schedule

In addition to doing the required readings and preparing for discussions, you will be responsible for writing a short (1-2 pg) reading response paper each week.

The supplementary readings and extended bibliography are meant to make you aware of the larger literature, and to provide a guide for those of you who need further preparation for your qualifying exams or dissertation research. They are **not mandatory**.

A note on books: all of the articles listed below will be made available electronically. The books you are responsible for borrowing, purchasing, or otherwise acquiring. I did not order them via the bookstore, as in most cases you can find better bargains elsewhere.

I August 22: Introduction & Provocations

Jennifer Gabrys et al. 2012. "Sensing an Experimental Forest: Processing Environments and Distributing Relations." *Computational Culture* 2; Mél Hogan. 2015. "Data Flows and Water Woes: The Utah Data Center." *Big Data & Society* 2, no. 2 (December 27): 1–12; Christophe Lécuyer. 2017. "From Clean Rooms to Dirty Water: Labor, Semiconductor Firms, and the Struggle over Pollution and Workplace Hazards in Silicon Valley." *Information & Culture: A Journal of History* 52 (3): 304–333

II August 29: What is Environmental History?

John Robert McNeill. 2009. *Something New under the Sun: An Environmental History of the Twentieth-Century World*. Vancouver, B.C.: Langara College

Supplemental Readings

Environmental history is a large and growing sub-field within the larger discipline of history, and is as much a set of methods and perspectives that can be applied very broadly to social scientific analysis as a particular set of topics. For some classics in the genre, see Worster (1985, 1993), Cronon (2009), White (2011), and Stine and Tarr (1998). Specific engagement with questions from science and technology studies can be found in Merchant (1990, 2013), Richards (2006), Steinberg (2004), and Jørgensen, Jørgensen, and Pritchard (2013). If you only read one other book in this genre, it should be Cronon (1996).

III September 5: The Myth of Informational Immateriality

Frans Berkhout and Julia Hertin. 2004. "De-Materialising and Re-Materialising: Digital Technologies and the Environment." *Futures* 36, no. 8 (October): 903–920; Ursula Huws. 1999. "Material World: The Myth of the Weightless Economy." *Socialist Register* 35, no. 35 (March 18)

Supplemental Readings

The notion that information is immaterial and that the new economy will be dominated by a shift from "atoms to bits" is so deeply entrenched in the popular literature on computing as to be almost ubiquitous, but some of the more influential arguments for this view can be found in Kelly (1999), Negroponte (1996), Martin (1978), Cairncross (2001), Bell (1973), and Schwarz and Leyden (1997). Not that the concept of "materiality" also has a technical meaning in media studies and other academic disciplines that is different from the common-sense understanding that material = physical. For examples, see Huhtamo and Parrika (2011), Pinch (2008), Leonardi (2010), Miller (2005), and Dourish (2017)

IV September 12: Infrastructure (Physical)

Nicole Starosielski. 2015. *The Undersea Network*. Duke University Press, February

Supplemental Readings

There are some excellent single-topic books exploring the various infrastructures that enable the modern Information Society, from the telegraph to fiber-optics: Hecht (2004), Müller (2016), Jones (2014), Blum (2013), and Carse and Lewis (2017). But infrastructure studies as a more general approach to understanding socio-technical systems has emerged in recent years as compelling body of literature. Star and Ruhleder (1996) is a classic.

V September 19: Infrastructure (Informational)

P N Edwards. 2010. *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming*. Cambridge, Mass: MIT Press

Supplemental Readings

Edward's *Vast Machine* is a masterwork in science studies, history of computing, and infrastructure studies. The article he co-authored called "Science friction: Data, metadata, and collaboration" (Edwards et al. (2011)) is more a more concise introduction to informational infrastructure, as is Jackson et al. (2007).

VI September 26: Yet more infratructure…

Misc infrastructure

VII October 3: Maintenance

David Edgerton. 2011. *The Shock of the Old: Technology and Global History since 1900*. New York: Oxford University Press

Supplemental Readings

In the past few years the study of maintenance — as opposed to innovation — has reinvigorated technology studies (Ferguson (2016), McCray (2018), and Russell and Vinsel (2018)). This move is closely associated with the increased focus on infrastructures, which require constant maintenance. This includes information infrastructures (including software, which is often regarded as immaterial; see Parikh (1984), C. Edwards (1984), and Ensmenger (2009)). Closely associated with the work of maintenance is repair, which is of particular concern to scholars studying e-waste (Jackson, Pompe, and Krieshok (2012), Rosner and Ames (2013), and Koebler (2017)).

VIII October 10: Extraction Economy

David S Abraham. 2016. *The Elements of Power: Gadgets, Guns, and the Struggle for a Sustainable Future in the Rare Metal Age*.

Supplemental Readings

From lithium (Fletcher (2011) to tin (Ingulstad, Perchard, and Storli (2014)) to rare earth elements (Veronese (2015)), there is a growing literature on the essential elements of the digital economy. There is a related literature on the geopolitical, environmental, and security implications of this association with the extraction economy. See for example Bethel, Panama, and Luo (2010) and Jaffe (2011). By focusing on the material foundations of digital devices, the connection the digital and industrial economy becomes even more apparent.

For some classic studies of pre-computer flows of material, see Sheller (2014), Robins (2011), and Mercury (2011).

IX October 17: Data Centers

Tung-Hui Hu. 2015. *A Prehistory of the Cloud.* MIT Press

Supplemental Readings

The media theorist John Durham Peter's *The Marvelous Clouds: A Philosophy of Elemental Media* (Peters (2015)) is a sweeping and beautiful history of nature and media that encompasses whales, clocks, and data centers. An early talk he gave on the material that became his chapter on "God and Google" was the inspiration for my own research in this area. In recent years the energy, water, and environmental costs of the Cloud have attracted the attention of geographers, political scientists, historians, and engineers: Carruth (2014), Sanjeevi et al. (2015), Glanz (2012b), Amoore (2016), Hogan (2017), Mills (2013), Weiss (2007), and Greenberg et al. (2008)

X October 24: Digital Residues

Elizabeth Grossman. 2007. *High Tech Trash: Digital Devices, Hidden Toxics, and Human Health.* 1st Island Press pbk. ed., Rev. ed. Washington: Island Press/Shearwater Books

Supplemental Readings

The public debate about the toxic effects of Silicon Valley semiconductor manufacturing begins in the 1980s (Bernstein et al. (1980) and Siegel and Markoff (1985)), diminishes with the move of such manufacturing abroad, and then resurges in the early 21st century (Gabrys (2013), Glanz (2012a), Adeola (2011), and Lepawsky (2015)). The literature on e-waste is refreshingly (or disturbingly, depending on whether you are thinking about it from a scholarly or environmental perspective), and includes not only Silicon Valley and Endicott, NY (Little (2014)) but also India (Jain and Chawla (2014)), China (Chiu (2011)), Africa (Oteng-Ababio (2012) and Grant and Oteng-Ababio (2012)), Taiwan (Chiu (2011)), and Bangladesh (Lepawsky and Billah (2011)), among other regions.

XI October 31: Communication Transportation

Alexander Klose. 2016. *Container Principle.* Cambridge, Massachusetts: The MIT Press

Supplemental Readings

One of the paradoxes of the information age is that, counter to the predictions of tech enthusiasts such as Negroponte (1996) and Kelly (1999), digital technologies have not eliminated the need for the physical movement of materials and people, but have rather facilitated it. As Ganz (1995) suggests, the story of containerized shipping — arguably one of the greatest contributors to globalization — is essentially the story of the information systems that make the logistical management of containers possible.

XII November 7: The World in/is a Computer

Jennifer Gabrys. 2016. *Program Earth: Environmental Sensing Technology and the Making of a Computational Planet.* Environmental Sensing Technology and the Making of a Computational Planet. March

Supplemental Readings

Although many of the readings for this course focus on the costs and potentially negative consequences of computing (or if not negative, at least negative in contrast to prevailing ahistorical utopianism that pervades much of tech culture), it is important to note than an environmental historical approach to computing is not essentially concerned with making value judgments or advocating for change. The goal is to understand the

mutually constructive interrelationship of nature and society. And there is no question that computational techniques and technologies have radically changed the ways humans perceive and interact with their environment, from meteorology (Nebeker (1995), Fleming (2011), and Harper (2011)) to ecology (Kingsland (1998), Hammond (1997), and Turnbull (2018)) to biology (Kay (2001), Johnston (2010), Helmreich (2007), and Emmeche (1994)) to geology (Carter et al. (2000) and Özkaya (1991)).

XIII November 14: The New Utopia

David N. Pellow and Lisa Sun-Hee Park. 2002. *The Silicon Valley of Dreams: Environmental Injustice, Immigrant Workers, and the High-Tech Global Economy.* The Silicon Valley of Dreams. New York: NYU Press

XIV November 21

Thanksgiving break.

XV November 28: Sustainable Digital Design

Mike Hazas and Lisa P Nathan. 2018. *Digital Technology and Sustainability Engaging the Paradox.* Abingdon, Oxon; New York, NY: Routledge

XVI December 5

Independent work on final papers.

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