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CARBON CAPITALISM, COMMUNICATION, AND ARTIFICIAL INTELLIGENCE

Placing the Climate Emergency Center Stage

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Communication plays a vital role in organizing or mystifying public understandings of the climate crisis and promoting or impeding action for change. Greta Thunberg's rise to celebrity status and Donald Trump's manipulation of Twitter and supportive media channels led by Fox News exemplify this pivotal role. However, communication and computation systems also generate a number of environmental harms, staring with mineral extractions, water, energy, and natural resources necessary for hardware and machine production; and then generating additional resource depletion for distribution, transportation, post-consumption of material technology, to end with major e-waste disposal needs. Added to this is the major environmental cost of data extraction, computing, and analysis. According to the International Energy Agency (IEA, 2022), data center electricity use in Ireland has more than tripled since 2015, accounting for 14% of total electricity consumption in 2021, while in Denmark, data center energy use is projected to triple by 2025 to account for around 7% of the country's electricity use.

This chapter draws on the tradition of critical political economy of communication and in particular on the theoretical elaboration developed in the books *Carbon Capitalism and Communication: Confronting Climate Crisis* (Brevini and Murdock, 2017) and in *Is AI good for the Planet* (Brevini, 2021), where communication systems (including its latest developments, Artificial Intelligence (AI) *in primis*) are approached as assemblages of material devices and infrastructures, capable of depleting scarce resources in their manufacturing, usage, and disposal. In fact, it is important to connect how the accelerating impact of human interventions on the Earth's ecosystems identified by climate research coincides with the rapid expansion of communication and computational systems. This has in turn drastically accelerated our consumption of raw materials and energy, compounding our global environmental challenges.

Pandemic, Climate Crisis, and Energy Consumption

The pandemic has hastened our dependence on technology along with the massive acceleration and the adoption of AI, big data, cloud computing, and video technologies. We eat, socialize, work, study, exercise online, and plug into the cloud. New research from Milkround (2021) in the United Kingdom reveals that video conferencing has surpassed email as the most widely used form of business communication during the lockdown. So, we are reliant on communication systems as

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never before, while the planet is facing the biggest crisis ever faced. We now know that unless emissions fall by 7.6% each year between 2020 and 2030, the world will miss the opportunity to get on track toward the 1.5°C goal. We also know that we are currently on a trajectory for a temperature rise of over 3°C (United Nations Environment Programme, 2019). Yet, for almost two years, we have been constantly bombarded by media reports that the pandemic has been incredibly good for the climate crisis by reducing climate emissions through taming transport, flights, and movement (Gössling and Humpe, 2020, 2). On the contrary, even despite the lockdowns of 2020, greenhouse gas emissions have remained stubbornly high. Daily global carbon dioxide emissions fell by as much as 17% in early April 2020. But, as the world's economy started to recover, emissions rebounded. The UN showed that 2020 only saw a 4–7% decline in carbon dioxide relative to 2019 (UN News, 2020). While transportation and industrial activity declined from January 2020, electricity consumption remained constant, which partly explains the minimal drop in emissions (IEA, 2020). How, you may ask? According to the World Energy Outlook 2019, globally 64% of the global electricity energy mix comes from fossil fuels (coal 38%, gas 23%, oil 3% [IEA, 2019]). Since fossil fuels are the largest source of greenhouse gas emissions, without fundamental shifts to renewable resources in global energy production, we shall not be able to prevent incalculable loss of life.

The book *Carbon Capitalism and Communication* has focused specifically on developing a type of communication scholarship that focuses on the materiality of communication systems: communication systems run on machines and infrastructures that deplete scarce resources in their production, consumption, and disposal, thus increasing the amounts of energy in their use, and exacerbating problems of the climate crisis (Brevini and Murdock, 2017). Researchers Lotfi Belkhir and Ahmed Elmeligi estimate that the tech industry's carbon footprint could increase to 14% by 2040, "accounting for more than half of the current relative contribution of the whole transportation sector" (Belkhir and Elmeligi, 2018, 448). Data centers will make up 45% of this footprint (up from 33% in 2010) and network infrastructure 24% (ibid., 457).

Understanding Artificial Intelligence and Its Environmental Toll

In dominant media debates, AI has been defined as the ability of machines to mimic and perform human cognitive functions. These include reasoning, learning, problem-solving, decision-making, and even the attempt to match elements of human behavior such as creativity. Human–Machine Communication (HMC), an emerging area of communication research, defined AI as the study of the "creation of meaning among humans and machines" (Guzman and Lewis, 2019, 71). Others instead focused on refinement and theory related to people's interactions with technologies such as agents and robots (Spence, 2019).

Most AI applications are already so embedded in our everyday life that we no longer notice. For example, the AI-enabled camera that helps control traffic, the facial recognition scan at airports, the latest smartphone applications recommending music videos on YouTube, and the smart homes powered by Amazon's Alexa. AI technologies are now employed in every sector of social, political, and economic relevance. They are used to translate languages, guide agricultural businesses, assess climate threats, advise corporations on HR and investments, fly drones, diagnose diseases, and protect borders. The AI industry is dominated by a handful of companies mainly, from the U.S. and China (Brevini, 2021; Kaplan and Haenlein, 2020). In both the leading countries, AI applications are controlled by "Digital Lords" (Brevini, 2020a), the tech giants who have come to dominate technology developments, both in the West (Google, Microsoft, Apple, Facebook/Meta, Amazon) and in China (Baidu, Tencent, Alibaba). In the last decade, these companies have become more aggressive in their competition for AI dominance by acquiring start-ups as well as heavily investing in compute capacity, leading to the concentrated AI industrial landscape we see today (Dyer-Witheford et al., 2019). Besides the U.S. and China, many countries in the northern hemisphere have invested heavily in funding for AI technologies and intellectual property. France, Israel, the United Kingdom, South Korea, and Japan have all joined the race for AI (Cognilytica, 2020).

In *Is AI Good for the Planet*, Brevini argues that the definition adopted by the latest *White Paper on Artificial Intelligence* issued by the European Commission serves as a good starting point to regain an understanding of the materiality of AI, highlighting the connection between AI, data, and algorithms: "AI is a collection of technologies that combine data, algorithms and computing power. Advances in computing and the increasing availability of data are therefore key drivers of the current upsurge of AI" (Brevini, 2021, 40). Embracing the tradition of critical political economy of communication, in which communication systems are approached as assemblages of material devices and infrastructures (Brevini and Murdock, 2017), AI then can be better understood as technologies, machines, and infrastructures that demand amounts of energy to compute, analyze, and categorize. As a consequence, these communication technologies use scarce resources in their production, consumption, and disposal, exacerbating problems of waste and pollution.

The Potentials of AI: Fixing the World, Fixing the Environment

AI – so we are told – is helping to solve some of the world's biggest challenges, from treating chronic diseases and reducing fatality rates in traffic accidents, to fighting climate change and anticipating cybersecurity threats (Brevini, 2020a,b, 2). AI is sold as the solution to the world's most pressing problems, so it's not surprising that it also promises to tackle the most urgent emergency: the climate crisis that the earth is facing. A report entitled *Harnessing Artificial Intelligence for the Earth*, published in January 2018 by the World Economic Forum, reiterated that the solution to the world's most pressing environmental challenges is to employ technological innovations – none more so than AI (World Economic Forum, 2018): "We have a unique opportunity to harness this Fourth Industrial Revolution, and the societal shifts it triggers, to help address environmental issues and redesign how we manage our shared global environment" (ibid., 3); "The intelligence and productivity gains that AI will deliver can unlock new solutions to society's most pressing environmental challenges: climate change, biodiversity, ocean health, water management, air pollution, and resilience, among others" (ibid., 19).

Technology has served for generations as the most efficient tool to address the inequalities of capitalism (Brevini, 2021), thus rescuing societies from unavoidable declines. Morozov (2013) describes how "Techno solutionism" entails an absolute faith in technology, carrying the power to change how we understand social phenomena. Embedded in this neoliberal, techno-determinist discourse is a belief digital technology can disrupt inequalities and power asymmetries. The concept of Ecomodernism (Asafu-Adjaye et al., 2015) echoes this sentiment. In contrast to those who place unequal capitalist power relations at the center of the climate emergency (Brevini and Murdock, 2017; Foster, 2002), the *Ecomodernist Manifesto* (Asafu-Adjaye et al., 2015) cites technology as our answer to the ecological crisis, shirking the need to confront the inherent environmental destructiveness of capitalism. Halting the many societal gains we have achieved through technological innovation, they argue, rules out the best tools we have for combating climate change, protecting nature, and helping humanity.

Authored by a group of sustainability figures from the Breakthrough Institute, including Nordhaus, Shellenberger, and Brand, 2015's *An Ecomodernist Manifesto* argues "meaningful climate mitigation is fundamentally a technological challenge" (Asafu-Adjaye et al., 2015). For ecomodernists, limitless economic growth is not disputed but encouraged. High-tech crops, tools for carbon capture and storage, and smart conservation, all have the potential to reduce human demands on the environment but also spark the economic growth needed to lift people out of extreme poverty. Ecomodernist ideas have been advanced in the last few years through the work of Harvard University cognitive linguist Steven Pinker who in his popular book, *Enlightenment Now* (Pinker, 2018), advocates for ecomodernism and the need for technologies such as nuclear energy. Ecomodernism is also being adopted in leftist circles (Isenhour, 2016), among scholars who claim "the idea that the answer to Climate Change is consuming less energy – that a shift to renewables will necessarily mean a downsizing in life – feels wrong" (Bastani, 2017). For Bastani, a proponent of fully automated green communism, "rather than consuming less energy, developments in wind and solar (and within just a few decades) should mean distributed energy of such abundance that we won't know what to do with it" (ibid., para. 33).

Despite its discussions around limiting greenhouse gas emissions, the International Kyoto Protocol also did little to dissuade an ecomodernist agenda, instead encouraging environmental advocates in the United States (see: Al Gore's presidential campaign) to push for technological improvement in energy efficiency as a way of averting environmental disaster (Foster, 2001, 2002). This view, which we similarly find in cybertarian Silicon Valley circles, turns into a powerful apology of the status quo and is embraced by the same corporate giants that traditionally opposed action on Climate Change.

Inequality and Exploitation: Understanding the Environmental Costs of AI as Communication Technologies

A study by the College of Information and Computer Sciences at University of Massachusetts Amherst (Strubell, Ganesh, McCallum, 2019) quantifies the energy consumed by running AI programs. In the case examined by the study, a common AI training model in linguistics can emit more than 284 tons of carbon dioxide equivalent. This is comparable to five times the lifetime emissions of the average American car. It is also comparable to roughly 100 return flights from London to NYC. Meanwhile, the converged communication systems upon which AI relies generate a plethora of environmental problems of their own, most notably energy consumption and emissions, material toxicity, and electronic waste (Brevini and Murdock, 2017). For example, while internet users increased globally by 60% from 3 billion to 4.9 billion in 2021, internet traffic increased by 440% with major consequences on the electricity supply. Data center energy usage increased by 60%, while for crypto mining, energy use went from 4 terawatt hours (TWh) to 100/140 TWh in five years between 2015 and 2021, an increase of over 300%/ (IEA, 2022).

AI relies on data to work. At present, cloud computing eats up energy at a rate somewhere between the national consumption of Japan and that of India (Greenpeace International, 2011; Murdock and Brevini, 2019). Today, data centers' energy usage averages 200 TWh each year (International Energy Agency, 2017; Jones, 2018), more than the national energy consumption of some countries, including Iran. Moreover, the information and communications technology (ICT) sector that includes mobile phones networks, digital devices, and television amounts to 2% of global emissions (Jones, 2018). Greenhouse gas emissions from the information and communication industry could grow from roughly 1 to 1.6% in 2007 to exceed 14% worldwide by 2040, accounting for more than half of the current relative contribution of the whole transportation sector. Moreover, data centers require large, continuous supplies of water for their cooling systems, raising serious policy issues in places like the U. S. and Australia where years of drought have ravaged communities (Mosco, 2017). As *Google's Deepmind* website explains,

> One of the primary sources of energy use in the data centre environment is cooling… Our data centres - which contain servers powering Google Search, Gmail, YouTube, etc. - also generate a lot of heat that must be removed to keep the servers running. This cooling is typically accomplished via large industrial equipment such as pumps, chillers and cooling towers.
>
> (Evans and Gao, 2016, para. 5)

According to *Deepmind*, the solution to this problem is, of course, Machine Learning, which is also extremely energy-consuming and generative of carbon emissions. When communication machines are discarded, they become electronic waste or e-waste, saddling local municipalities with the challenge of safe disposal. This task is so burdensome that it is frequently offshored, and many countries with developing economies have become digital dumping grounds for more privileged nations (Brevini and Murdock, 2017).

Finally, while promising to solve the climate emergency, AI companies are marketing their offers and services to coal, oil, and gas companies, thus compromising efforts to reduce the emissions and divest from fossil fuels. A report on the future of AI in the oil and gas market published by Zion Market Research (2019) found that the sector of AI in oil and gas is expected to reach around USD 4.01 billion globally by 2025 from 1.75 billion in 2018. AI companies around the world are pushing their capabilities to the oil and gas sectors to increase their efficiencies, optimize their operations, and increase productivity. In other words, they are selling their services to increase the pace and productivity of excavation and drilling. ExxonMobil, for example, signed a partnership with Microsoft to deploy AI programs, while oil and gas exploration in the fragile ecosystem of Brazil have seen the deployment of AI technology by state oil giant Petrobras. Similarly, European oil major, Royal Dutch Shell, signed a partnership with AI company C3.

Placing the Climate Emergency at the Center of Communication Scholarship

New developments of AI escalate demands on energy, water, and resources in their production, transportation, and use; reinforce a culture of hyper consumerism; and add to the accumulating amounts of waste and pollution already generated by accelerating rates of digital obsolescence and disposal (see Brevini, 2021; Gabrys, 2011). Instead of embracing new developments in communication technologies and AI as a new utopia that will fix the world and capitalism problems, we should start quantifying and considering the environmental costs and damages of the current acceleration of algorithm-powered data communication. We need to ask who should own and control the essential infrastructures that power data communication and AI and make sure to place the climate emergency at the center of the debate.

How can we shape the future of AI to be one of collective well-being and minimized climate impact? Certainly, an intervention at global and international public fora would be crucial. One interesting piece of policy in this regard is the European Commission report, "Strategic Foresight Report 2022" (European Commission 2022) on "Twinning the green and digital transition in the new geopolitical context" (ibid). It stresses the crucial role of the "twin transition" of green and digital at the top of the EU's political agenda. What is crucial is that for the first time, the European commission is explicit about the fact that digital technologies will also bring additional environmental burdens with them. In particular, it explains that,

> Unless digital technologies are made more energy-efficient, their widespread use will increase energy consumption … Studies show that ICT power consumption will continue to grow, driven by increasing use and production of consumer devices, demand from networks, data centres, and crypto assets.
>
> (European Commission, 2022)

It further acknowledges that "further tensions will emerge in relation to electronic waste and environmental footprints of digital technologies." However, despite growing attention to the environmental costs of ICT systems, AI gets principally heralded as the key technology to solve contemporary challenges, including the environmental crisis, which is one of the goals of sustainable development. In fact, it seems that global discussions on the climate emergency – for example in the context of UN COP – are yet to connect the environment with technology policy.

We know many corporations now audit the production conditions of sub-contractors' factories, but there is still an urgent need to demand accountability for those who own data centers. One crucial intervention could be to government-mandated Green Certification for server farms and centers to achieve zero emissions. Given AI's increasing computing capabilities, the disclosure of its carbon footprint could be a first step in the right direction. This could take the form of a "Tech Carbon Footprint Label," which would provide information about the raw materials used, the carbon costs involved, and what recycling options are available, resulting in stronger public awareness about the implications of adopting a piece of smart technology. Making transparent the energy used to produce, transport, assemble, and deliver the technology we use daily would enable policy makers to make more informed decisions, and for the public to make more informed choices. Added to this could be policy intervention which requires manufacturers to lengthen the lifespan of smart devices and provide spare parts to replace faulty components.

Global policy making should encourage educational programs to enhance green tech literacy and raise awareness of the costs of hyper-consumerism, as well as the importance of responsible energy consumption. Green tech literacy programs should also entail interventions to ban production of products that are too data-demanding and deplete too much energy, such as the request by the EU commissioner to lower the default quality of video streams services by Netflix, YouTube, and Amazon to preserve bandwidth during the coronavirus lockdowns. As the global pandemic crisis has shown, governments around the world can act fast when urgent action is needed in the public good.

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