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Black boxes, not green: Mythologizing artificial intelligence and omitting the environment

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Abstract

We are repeatedly told that AI will help us 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. However, the article contends that public discourse on AI systematically avoids considering AI's environmental costs.
Artificial Intelligence- Brevini argues- runs on technology, machines, and infrastructures that deplete scarce resources in their production, consumption, and disposal, thus increasing the amounts of energy in their use, and exacerbate problems of waste and pollution. It also relies on data centers, that demands impressive amounts of energy to compute, analyse, categorize. If we want to stand a chance at tackling the Climate Emergency, then we have to stop avoiding addressing the environmental problems generated by AI.

Keywords

Environmental communication, environmental costs, artificial intelligence, Big Data, political economy of communication, environmental costs of technology

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Data analytics now pervades every domain of our lives, from medicine and voting to law enforcement, education, terrorism prevention, communication and cyber-security. The trend has gone hand in hand with developments of Artificial Intelligence that needs even more data to work. The assumption is always that artificial intelligence (AI) & Big Data will make algorithmic assessments much fairer than human judgments (Allen and Chan, 2017; Economist, 2017; European Commission (EC), 2018a, 2018b).

However, the *Black Box* metaphor outlined by Frank Pasquale (2015) in his landmark volume "The Black Box Society" demonstrated that this is not quite the case. The book offered us a theoretical framework through which to understand the worrisome information asymmetry embedded within the algorithmic turn. While many corporations have a direct window into our lives through continuous, ubiquitous data collection, our knowledge of how the "black box" works is opaque and uncertain, closely guarded by private companies and inaccessible to researchers or the broader public (Pasquale, 2015). Simply put: "the profit advantage of informational exclusivity was too strong to resist" (Pasquale, 2015: 193). Furthermore, Pasquale argues, the politico-economic imperatives of speed, scale, and speculation promote irresponsibility and lack of accountability. This, in turn, reinforces inequalities that can exclude, isolate, and damage the most vulnerable in society.

With this article, I'd like to open another *black box* that concerns the recent acceleration of AI developments: data mining and computational evaluations of persons and corporations have far-reaching

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environmental costs. After exploring the promises of AI, the article will show that it is critical to a complex of interlinked innovations in technology, machines and infrastructures. These material apparatuses and technologies deplete scarce resources in their production, consumption and disposal, thus increasing the amounts of energy expended in their use and exacerbate problems of waste and pollution. AI also relies on data centers that demand impressive amounts of energy to compute, analyze, and categorize with grave consequences for the Climate Emergency.

The promises of AI

Dominant narratives in international media have enshrined Artificial Intelligence as the battleground for global dominance and progress, with leadership in AI technology and systems hailed as the key marker of victory (Economist, 2017). From the US to China, world leaders are invested in making AI the business opportunity of the future—and thereby selling it as a virtue and a public good (Economist, 2018).

In this article, I will employ the definition of AI adopted by the latest *White Paper on Artificial Intelligence* (EC, 2020) issued by the European Commission, because it clearly highlights 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" (EC, 2020: 2).

On 7 December 2018, the European Commission published a coordinated action plan on the development of AI in the EU (EC, 2018a, 2018b). It pledged to increase its annual investments in AI by 70% under the research and innovation programme Horizon. We are told that AI will help us 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 (EC, 2018a, 2018b). A survey I conducted on AI strategy reports issued by different states in Europe shows how public discourses on AI have overwhelmingly positive connotations (Brevini, 2020; HighLevel Expert Group, 2019a, 2019b). Concerns, where they are voiced, focus almost exclusively on the objective of delivering "ethical AI" (High-Level Expert Group, 2019a) "trustworthy AI" (High-Level Expert Group, 2019b), and fair or equitable AI—with AI itself always positioned as an inevitable reality (Benkler, 2019).

It is through the legitimation of dominant discourses (Brevini and Schlosberg, 2016; Foucault, 1980, 1981) when discourses become hegemonic (Brevini, 2020; Gramsci, 1996), that they can direct attention from the public, construct and promote digital developments, communication policy, and legitimate modes of governance that would not have been possible without the establishment of such a discourse (Brevini and Schlosberg, 2016). Thus, despite the existential threat of climate change emerging as humanity's greatest challenge, the environmental costs of AI, algorithms, and data analytics are not accounted for when developing new policies on AI. Incomplete discourses that become dominant can shape how society embraces technological developments.

There are philosophical and historical reasons for this deafening silence on AI's environmental impact. Scholars in critical political economy of communication have showed how discourses around digital technologies have historically been constructed as modern myths decorated with allusions to utopian worlds and new possibilities (Brevini, 2020; Mosco, 2014). As Mosco succinctly explained, "almost every wave of new technology, including information and communication media, has brought with it declarations of the end . . . Since these tend to take place with no reference to similar proclamations in the previous wave, one cannot help but conclude that the rhetoric of technology (. . .) is powerful enough to create a widespread historical amnesia" (Mosco, 2014: 130). The technological deterministic argument that technology can and will fix capitalism—and its intrinsic power to exacerbate inequalities of economic, racial, gender forms—is far from being a recent elaboration (Negroponte, 1998). To use the words of Mosco, "One generation after another has renewed the belief that, whatever was said about earlier technologies, the latest one will fulfil a radical and revolutionary promise" (Brevini, 2020; Mosco, 2014: 21). This framing of AI as the magic tool to rescue the global capitalist system from its dramatic crises obfuscates the materiality of the infrastructures that are central to the environmental question that has been so consistently and artfully ignored (Brevini, 2020).

There is another critical reason to neglect the environmental problem (Brevini, 2016). Central to the "sale" of new technologies to the global public is the fabricated notion that further technological advances provide the best—indeed the only—roadmap to ending the existential threat of climate change (World Economic Forum, 2018).

It is difficult not to see the connection between this roadmap and the claims of what has become known as Eco Modernism (Asafu-Adjaye et al., 2015). Against those who place the 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) argues that technologies can fix the ecological crisis without the need to

address the inherent environmental destructiveness of capitalism (Symons, 2019). Published in 2015, the Eco Modernist Manifesto was authored by a group of figures in the sustainability movement like Nordhaus, Shellenberger, and Brand, and associated with the Breakthrough Institute, a US think tank traditionally critical of environmental groups (Asafu-Adjaye et al., 2015). The principal mantra of Ecomodernism is that "Meaningful climate mitigation is fundamentally a technological challenge", so the necessity of limitless economic growth is not disputed but (Asafu-Adjaye et al., 2015).

Ecomodernism has also found traction in leftist circles (Isenhour, 2016), particularly among those scholars who felt that "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 the *Fully automated green communism* (Bastani, 2017). "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" (Bastani, 2017).

The International Kyoto Protocol on global warming, while designed to limit the greenhouse gas emissions of nations, has in fact further entrenched this ultra-optimistic faith in technology, encouraging many environmental advocates in the United States (including Al Gore in his presidential campaign) to push for technological improvement in energy efficiency to avert environmental disaster (Foster, 2001, 2002). This view, which we similarly find in cybertarians' Silicon Valley circles, turns into a powerful apology for the status quo and is embraced by the same corporate giants that traditionally opposed action on Climate Change.

In line with this logic, a recently released 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 harness technological innovations—none more so than AI (World Economic Forum, 2018). "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" (World Economic Forum, 2018: 19). This bold vision, insistently argued by advocates as if it were common sense (Gramsci, 1996) makes once again no reference to the materiality of AI and its environmental consequences.

Unfortunately, the carbon footprint of AI-powered algorithms is not only largely absent from public discourses on AI developments, but often it is neglected in the academy (Brevini, 2020).

Placing the environmental costs at the Center of AI developments

Research in the field of communication systems, technology, and the environment is sparse (Brevini and Murdock, 2017; Maxwell and Miller, 2012, Rust et al., 2015). However, a new study published in June 2019 by the College of Information and Computer Sciences at University of Massachusetts, Amherst has for the first time attempted to quantify the energy consumed by running AI programs (Strubell et al., 2019). In the case examined by the study, a common AI training model in Linguistics can emit more than 284 tonnes of carbon dioxide equivalent (Strubell et al., 2019). This is comparable to five times the lifetime emissions of the average American car. It is also comparable to roughly 150 return flights from London to NYC (Guardian, 2019). And AI models' energy consumption does not stop after training but extends to its utilization. Meanwhile, the converged communication and computational 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). According to the International Energy Agency (2017) if the energy demand continues to accelerate at this pace, even just the residential electricity needed to power electronics will rise to 30% of global consumption by 2022, and 45% by 2030 (Maxwell, 2015).

AI relies on data to work. At present, cloud computing eats up energy at a rate somewhere between what Japan and India consume in their national energy markets (Greenpeace, 2017; Murdock and Brevini, 2019; Vidal, 2017). Today, data centers' energy usage averages 200 TWh each year (International Energy Agency, 2017; Nature, 2018) more than the national energy consumption of some populous countries such as Iran.

Furthermore, most data centers require large, continuous supplies of water for their cooling systems, raising serious policy issues in places like the US where years of drought have ravaged communities (Mosco, 2017).

One of the latest reports that estimated the carbon footprint of ICT (including servers networks and devices) sketches an even more concerning picture. The energy consumption of digital technologies is increasing by 9% a year, and already represents 3.7% of global greenhouse gas emissions (Shift Project, 2019). This percentage of emissions is almost double

that of the aviation industry, currently at 2% (Guardian, 2019).

Finally, when communication and computational 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).

Ecological criticism has for decades firmly established that it is the violence and inequality of capitalism that have ultimately caused the ecological emergency we now face (Foster, 2001, 2002). Adding to this view, I argue that the acceleration of the impact of human interventions on the Earth's ecosystems identified by climate research coincides with significant rushing and development of communication and computational systems (Brevini and Murdock, 2017). This has in turn drastically accelerated our consumption of raw materials and energy, rapidly compounding our global environmental challenges. Thus, in addition to understanding the opaqueness of black box algorithms, we must also shine light on their environmental costs. Quantifying and considering the environmental costs and damages of the current acceleration of algorithm-powered AI, as well as the mythological machine that drives and protects its growth, will be one of our greatest hurdles in confronting the climate emergency.

As AI necessitates more and more computing capabilities, measuring the carbon footprint of computing and disclosing this information would be a first step in the right direction. One solution could be to offer a transparent account of the carbon footprint of AI-powered devices in the form of a "Tech Carbon Footprint Label" to raise awareness and adequately inform regulators and the public about the implications of the adoption of each piece of smart technology. To go back to the useful metaphor developed by Pasquale (2015), curbing the scope and power of black box decision making is essential. Black Boxes are not Green.

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References

Allen G and Chan T (2017) Artificial intelligence and national security. Belfer Center for Science and International Affairs. Available at: www.belfercenter.org/sites/default/files/files/publication/AI%20NatSec%20-%20final.pdf (accessed 20 March 2020)

Asafu-Adjaye J, Blomquist L, Brand S, et al. (2015) An ecomodernist manifesto. Available at: www.ecomodernism.org (accessed 10 April 2020).

Bastani A (2017) Fully automated green communism. Available at: https://novaramedia.com/2017/11/19/fully-automated-green-communism/ (accessed 1 April 2020).

Benkler Y (2019) Don't let industry write the rules for AI. *Nature* 569(7755): 161–161.

Brevini B (2016) The value of environmental communication research. *International Communication Gazette* 78(7): 684–687.

Brevini B and Murdock G (2017) *Carbon Capitalism and Communication: Confronting Climate Crisis*. London: Palgrave Macmillan.

Brevini B (2020) Creating the technological saviour: The myth of Artificial Intelligence in Europe. In: Verdigen P (ed.) *AI for Everyone*? London: University of Westminster Press. [In press].

Brevini B and Schlosberg J (2016) Between philosophy and action: the story of the media reform coalition. In: *Strategies for Media Reform*. New York: Fordham University Press, pp.123–137.

Economist (2017) China May Match or Beat America in AI. Available at: www.economist.com/news/business/21725018-its-deep-pool-data-may-let-it-lead-artificial-intelligence-china-may-match-or-beat-america?zid = 291&ah = 906e69ad01d2ee51960100b7fa502595 (accessed 20 February 2020).

Economist (2018) In the struggle for AI China will prevail. Available at: www.economist.com/books-and-arts/2018/09/27/in-the-struggle-for-ai-supremacy-china-will-prevail (accessed 20 February 2020).

European Commission [EC] (2018a) Final Communication from the Commission to the European Parliament, The European Council, the Council, the European Economic and social Committee and the Committee of the regions. Artificial Intelligence for Europe, 26 April 2018. Available at: https://ec.europa.eu/transparency/regdoc/rep/1/2018/EN/COM-2018-237-F1-EN-MAIN-PART-1.PDF (accessed 20 February 2020).

European Commission [EC] (2018b) 237 Final Communication from the Commission to the European Parliament, The European Council, the Council, the European Economic and social Committee and the Committee of the regions. 7 December 2018. Available at: https://ec.europa.eu/knowledge4policy/publication/coordinated-plan-artificial-intelligence-com2018-795-final_en (accessed 20 February 2020).

European Commission [EC] (2020) On artificial intelligence - A European approach to excellence and trust. Available at: https://ec.europa.eu/info/publications/white-paper-artificial-intelligence-european-approach-excellence-and-trust_en (accessed 20 February 2020).

Foster JB (2002) Capitalism and ecology: The nature of the contradiction. *Monthly Review* 54(4): 6.

Foster JB (2001) Ecology against capitalism. *Monthly Review* 53(5): 1.

Foucault M (1980) *Power/Knowledge: Selected Interviews and Other Writings, 1972-1977*. Brighton: Harvester Press.

Foucault M (1981 [1970]) The order of discourse. Inaugural lecture at the Collège de France 2nd December 1970. In: Young R (ed.) *Untying the Text, A Post-structuralist Reader*. Boston: Routledge and Kegan Paul, pp. 48–78.

Gramsci A (1996) Quaderni Dal Carcere. In: Rosa A (ed.) *Letteratura Italiana Einaudi, Le Opere*. Torino: Einaudi, pp. 553–629.

Greenpeace (2017) Clicking clean report. Available at: www.greenpeace.org/usa/global-warming/click-clean/ (accessed 22 March 2020).

Guardian (2019) How your flight emits as much CO2 as many people do in a year. Available at: www.theguardian.com/environment/ng-interactive/2019/jul/19/carbon-calculator-how-taking-one-flight-emits-as-much-as-many-people-do-in-a-year (accessed 20 March 2020).

High-Level Expert Group (2019a) Ethics guidelines for trustworthy AI. Available at: https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai (accessed 22 March 2020).

High-Level Expert Group (2019b) Policy and investment recommendations for trustworthy AI. Available at: https://ec.europa.eu/digital-single-market/en/news/policy-and-investment-recommendations-trustworthy-artificial-intelligence (accessed 22 March 2020).

International Energy Agency (2017) Digitalization and energy. Available at: www.iea.org/reports/digitalisation-and-energy (accessed 1 March 2020).

Isenhour C (2016) Unearthing human progress? Ecomodernism and contrasting definitions of technological progress in the anthropocene. *Economic Anthropology* 3(2): 315–328.

Maxwell R (2015) High-tech consumerism, a global catastrophe happening on our watch. Available at: https://theconversation.com/high-tech-consumerism-a-global-catastrophe-happening-on-our-watch-43476 (accessed January 2020).

Maxwell R and Miller T (2012) *Greening the Media*. Oxford: Oxford University Press.

Mosco V (2014) *To the Cloud: Big Data in a Turbulent World*. Boulder, CO: Paradigm.

Mosco V (2017) The next internet. In: Brevini B and Murdock G (eds) *Carbon Capitalism and Communication: Confronting Climate Crisis*. London: Palgrave Macmillan, pp.95–107.

Murdock G and Brevini B (2019) Communications and the capitalocene: Disputed ecologies, contested economies, competing futures. *The Political Economy of Communication* 7(1): 51–82.

Nature (2018) How to stop data centres from gobbling up the world's electricity. Available at: www.nature.com/articles/d41586-018-06610-y (accessed 20 February 2020).

Negroponte N (1998) Beyond digital. *Wired* 6(12): 288.

Pasquale, F. (2015). *The Black Box Society*. Harvard University Press.

Rust S, Monani S and Cubitt S (2015) *Ecomedia: Key Issues*. New York: Routledge.

Shift Project (2019) Lean ICT – Towards digital sobriety, Report of the working group directed by Hugues Ferreboeuf. Available at: https://theshiftproject.org/wp-content/uploads/2019/03/Lean-ICT-Report_The-Shift-Project_2019.pdf (accessed 2 January 2020).

Strubell E, Ganesh A and McCallum A (2019) Energy and policy considerations for deep learning in NLP. Available at: https://arxiv.org/abs/1906.02243 (accessed 20 February 2020).

Symons J (2019) *Ecomodernism: Technology, Politics and the Climate Crisis*. New York: John Wiley & Sons.

Vidal J (2017) Tsunami of data could consume one fifth of global electricity by 2025. Climate Change News. Available at: www.climatechangenews.com/2017/12/11/tsunami-data-consume-one-fifth-global-electricity-2025 (accessed 20 January 2020).

World Economic Forum (2018) Harnessing Artificial Intelligence for the Earth World Economic Forum System Initiative on Shaping the Future of Environment and Natural Resource Security in partnership with PwC and the Stanford Woods Institute for the Environment. Available at: www.weforum.org/projects/fourth-industrial-revolution-and-environment-the-stanford-dialogues (accessed 20 January 2020).