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AI Software/Hardware as Mind/Body Problem

Global Supply Chains, Shadow Workers, and Wasted Lives

Abstract

Artificial intelligence (AI) and other algorithm-based technologies have become part of everyday life over the last decade. While AI holds amazing potential and has already contributed positively to the human condition, it is also subject to fierce critique as it may, for example, reproduce bias and social injustices or increase dystopic forms of surveillance. While most scholarly, regulatory, and ethical debates focus on AI software-related issues, AI hardware receives far less attention. Understanding AI as software, as an artificial mind, highlights only the supposedly new and exciting aspects of this technology and ignores the human and material costs of its fabrication. This is consistent with the traditional mind-body dualism, which prioritises mind over body and thus skews our perception of the problem. To counter the dominant narratives, this article proposes a concept of AI as hardware/software to broaden the scope of ethical and legal issues that ought to be addressed through AI regulation. A holistic and systemic treatment of the AI phenomenon robs it of its perceived uniqueness. Once the worldwide extraction of materials, labour, and data necessary to set up AI machinery is seriously considered, AI stands out as yet another instance of colonial capitalism.

Key words

artificial intelligence, ethics, human rights, extractivism, colonialism.

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1. Introduction**

Artificial intelligence (AI) is the buzzword of the day. From advertisements and movie suggestions to police surveillance and healthcare, it seems that AI and other algorithm-based technologies have entered all spheres of human existence. This process is enveloped in a complex aura of dread and hope that mirrors the partial and confused understandings of what AI technology is and what it might become. In the popular imagination, as well as in scholarly and regulatory debates, AI software is the privileged object/subject of interest. AI software—or rather, its potential—excites human imagination much more than the material conditions that allow AI to exist and function. Excessive focus on AI (as) software thus distorts our understanding of contemporary technologies and their ethical and legal implications.

In contrast, a holistic understanding of AI requires recognising that AI software cannot exist and function without hardware and that separating the two in ethical and regulatory debates obscures more than it illuminates. I propose a conception of AI as hardware/software to highlight the materiality of the phenomenon and allow for its thorough scrutiny. A materialist understanding of AI widens the scope of concern and brings the issue of the rights of inhabitants and environments of the Global South into the fold of AI ethics. Critical analysis of the disproportionate focus on software in the AI debates can benefit from reframing this problem as another instance of mind-body dualism. This dualism has marked Western thought for centuries, and various strands of critical theory denounce mind-body dualism for prioritising mind over body and consequently contributing to an array of stereotypes and social hierarchies. The excessive focus on software, the artificial mind, has similar effects, as it often eclipses the physical realities sustaining it.

Applying the critique of mind-body dualism to mainstream debates on AI thus provides a powerful prism for a systemic re-evaluation of techno-solutionist narratives concerning climate change and other pressing issues facing our planet. Furthermore, understanding AI as hardware/software erodes the hype surrounding AI's uniqueness. Treating the AI machine as a mere part of a more extensive technocapitalist apparatus is necessary to conduct a sober debate on the role of technology in the unfolding planetary drama. To provide a critical analysis of sidelining hardware issues and their consequences for (non) human beings and the environment, I depart from the right to life, understood as a right to a dignified life.[1] AI weapon systems or fatalities on the streets where smart self-driving

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[1] As being alive is crucial for one's enjoyment of other human rights, the right to life has been interpreted as one of the most basic and all-encompassing human rights, despite the nominal absence of hierarchy among them. The boundaries of the right to life are porous and unclear, as is the case with

cars are tested, for example, are not the only instances where AI infringes on the right to life. The AI industry also encroaches on the right to life of people living in communities whose access to safe drinking water, moderately clean air, safe food, and other basic provisions is denied because of the extraction of resources, production facilities, or dumping grounds for machines that no longer serve us. Moreover, a dignified life denotes freedom from slavery and extreme exploitation.

To unpack the issues described above, it is necessary to understand the loose signifier AI. Accordingly, the article first briefly engages with various attempts to define AI technologies and proceeds with a short overview of existing regulatory strategies and their shortcomings (section 2). Defining and regulating a swiftly developing phenomenon focuses on differentiating it from all others: in the case of AI, the distinguishing factor is AI software capable of autonomous adjustments. The focus on software in regulatory debates sidelines concerns such as human rights violations and the destruction of the environment in the process of hardware production. A theoretical framework to explain this tendency, the prism of mind-body dualism and decolonial theory, is then provided (section 3). The argument that software issues eclipse a swarm of legal and ethical problems is illustrated by examples of the extraction of minerals, labour and data and the environmental implications of these practices (section 4). The conclusions bring different strands of the article together and propose that focusing on what makes AI the same as—rather than different from—all other technologies and consumer goods makes an important contribution to debates on AI (section 5).

Eroding the narrative of AI's uniqueness is one of the main focal points of this article. While research on AI-specific threats to human rights and other values is necessary and important, it is also important to consider the ways in which AI technology is entangled in the longstanding global system of extraction and consumption rooted in human rights violations. Before engaging with this argument, the following section addresses the elusive definition of AI.

2. To Define is to Regulate

2.1. Defining AI: Mythology and Materiality

Scientific prose and regulatory interventions cannot escape the slippery terrain of notions that tend to denote, yet never capture, the essence of phenomena. Like many important concepts, including the very concept of intelligence, AI escapes a clear definition. AI is usually defined broadly, for example, as "the science and engineering of

any right. Nevertheless, dignified life implies that each human being should have access to basic provisions like drinking water, food, and shelter in an environment free from extreme pollution. See: Casey-Maslen & Heyns, 2021, pp. 11–15.

making intelligent machines, especially intelligent computer programs".[2] Most discussions revolving around AI today focus on various forms of machine learning. Machine learning algorithmic tools automatically "learn" and adjust themselves over time without explicit human programming. Generally, AI systems are understood as machines somewhat similar to human intelligence,[3] with human intelligence representing the yardstick in the field. Similarity to the human mind is recognised in the machine's ability to "learn" to identify patterns in the data and make predictions and decisions. Critical scholars operating with a holistic understanding of the phenomenon warn that AI systems are neither artificial nor intelligent but embodied and profoundly political.[4] AI might thus be considered a heavily mystified regime of truth based on knowledge extractivism and epistemic colonialism.[5] Before engaging with these arguments, the AI concept needs to be further unpacked.

The flourishing of AI technologies in recent decades has been enabled by combining large amounts of data, sophisticated algorithms, and ever-rising computing power.[6] More and more data are captured and extracted as technology proliferates. Algorithms, sets of instructions for computers to perform, require less and less pre-programming. Many of the ideas driving the development of AI systems today have been around for decades but could not be implemented due to a lack of computing power.[7] Computing power has risen dramatically in recent decades, roughly doubling every two years.[8] As computing power increases, computer chips are becoming smaller, and computer processing faster and faster. This perfect storm allowed for the AI spring we are currently experiencing.

Definitional open-endedness is one of the factors that hinders meaningful regulation of AI and could hardly be resolved in this article.[9] The proposed conception of AI as hardware/software builds on the understanding of AI as embodied and thus aims towards a definition of AI that necessarily includes the mundane material aspects of the phenomenon. The definition of AI used in this article is rather broad: AI as hardware/software is not necessarily limited to machines that mimic neural networks but entails all contemporary technology necessary for the functioning and development of AI systems.

While science fiction and news sensationalism contribute to utopic and dystopic ideas about AI's capabilities, most AI systems are not as intelligent as people think; in fact, a lot of work goes into hiding how "stupid" they are. Different tricks, including

2 McCarthy, 2007.

3 Scherer, 2016.

4 Crawford, 2021, pp. 7–9.

5 Joler & Pasquinelli, 2020.

6 Maclure, 2020.

7 Mitchell, 2019, pp. 27–66.

8 Shalf, 2020.

9 Buiten, 2019; Hoffmann & Hahn, 2020.

paying people to pretend to be AI systems, are employed to maintain the illusion of machine autonomy.[10] What goes under the name of AI is not intelligence in the sense of understanding but powerful statistical tools with a great capacity to perceive patterns in vast amounts of data. Accordingly, what exists at present may be referred to as weak or narrow AI systems that can perform complicated repetitive tasks that the machine was created to perform.[11]

Strong or general AI, or artificial general intelligence (AGI), does not exist (yet). The hypothetical AGI would amount to an artificial human mind capable of performing various tasks and understanding data. It would also have its own volition, reasons, desires and would learn and develop like a human child. It is unclear when (and if) AGI will come to be, what it would actually be like, or what kind of consequence it would bring. Obsession with AGI or singularity, a rise of self-conscious, all-powerful, and incredibly intelligent machines, is a powerful myth that attracts a lot of attention, often at the expense of the problems AI technology is already causing for traditionally discriminated groups of the population.[12] Fixation on building human-like AI is also pushing the industry to focus on developing tools that could replace human beings rather than developing AI tools that might complement and assist them. In practice, a collaboration between humans and AI technology is far more realistic and efficient since people are integral in training and explaining the workings of the machines, which can, in turn, assist humans with automatable tasks.[13]

Pushing the AGI mythology aside, its meagre approximation in the form of weak AI has become an integral part of our lives. AI systems are increasingly used in a broad spectrum of domains, from employment, education, healthcare, and welfare to warfare, from judiciary and law enforcement to advertisement and entertainment. Most AI today is developed for commercial reasons by corporate actors, and many issues associated with contemporary AI are rooted in increasing social inequalities and regulatory capture.[14] While AI certainly has many exciting and valuable applications and potentials, it is but a human-made tool with human flaws: various instances of (intersectional) discrimination against women, people of colour, queer people, people with disabilities, and other marginalised groups are regularly reported.[15] Social media using AI tools to hook users and moderate content have found themselves at the heart of debates about democracy, freedom of expression, and users' mental health.[16] All these—and other—controversies

10 Crawford, 2021, pp. 63–69.

11 Searle, 2009.

12 Crawford, 2016.

13 Wilson & Daugherty, 2018.

14 Bryson, 2020.

15 West Myers Whittaker & Crawford, 2019; Whittaker *et al.*, 2019.

16 Rouvroy, Berns & Carey-Libbrecht, 2013; Balkin, 2017.

make the regulation of AI technologies a pressing issue. Regulation lagging behind the developments on the ground is not unique to AI, but given the speed and role of technological development, the issue of AI regulation seems extremely acute, as the following subsection sketches out.

2.2. Regulating AI: Profits and Lives

Discrimination and other potential fundamental rights violations are some of the key issues driving AI regulatory development. It seems that the user, the principal and fungible subject of technocapitalism, presupposes a particular type of human embodiment; in the case of Western AI, a white cis, non-disabled, affluent Western man. People who do not fit the image of this prototype user often experience difficulties when interacting with AI systems.[17] AI developed by Chinese companies faces similar criticism of perpetuating gender stereotypes and race profiling of ethnic minorities.[18] The prototype embodiment coincides with the identity parameters of those developing AI systems in their image, at the expense of other groups and other epistemologies.[19] AI bias is a complex social issue rooted in the historical bias of software developers and people processing the data, non-representative and problematic datasets, and algorithmic bias instilled in the machine.[20]

AI bias is a pressing concern, as it threatens to reproduce and cement many of the existing injustices within our societies. AI bias and other risks, such as privacy concerns, the potential of AI for nudging and manipulating people, and threats to safety and security, contribute to the race to regulate AI amongst the most powerful actors in the field.[21] Nevertheless, relatively few legislative efforts have been made thus far to regulate AI, and arguments that regulation will stifle development and arrest progress carry (too) much weight. The European Union (EU), unlike the United States (US) and China, is not home to important "Big Tech" corporations developing and marketing AI systems. The EU has a plan, though: it aims to become a significant player in the AI industry through regulation and governance.

Based on its soft-law guidelines addressing AI issues, the EU Commission proposed the so-called "AI Act", a mixture of instruments aiming to boost the development of the AI industry in the EU and instruments aspiring to address fundamental rights concerns.[22] The final shape of this regulation, expected to be enacted in 2023, remains unclear, but it is a revolutionary step in the hard-law regulation of AI. Critics warn that the proposed

17 Buolamwini & Gebru, 2018; Shabbar, 2018.

18 See, e.g., Zhang, 2021; Mozur, 2019.

19 Abdilla *et al.*, 2021.

20 Joler & Pasquinelli, 2020.

21 Smuha, 2021.

22 Veale & Borgesius, 2021.

Act repeats the EU's colonialist attitudes and that the balance between economic goals and ethical principles is fragile and likely to favour economic and security concerns.[23] The human rights and the environment the EU is supposedly so eager to protect are those of its citizens-users, as the Act completely ignores the rights and environments harmed in the pre-stages of producing the final—high-value—AI products.

The EU is not alone in its zeal to comprehensively regulate AI; China is another trailblazer in AI regulation and development.[24] If hard law regulating AI technologies is in its embryonic stages, the situation is starkly different when it comes to soft law instruments. Here, the EU and China are far from the only actors: guidelines for ethical AI are mushrooming and being developed by nongovernmental organisations (NGOs), corporations, governments, transnational organisations, academic institutions, and others.[25] Ethical guidelines have limited scope and differ depending on who is drafting them. Nevertheless, buzzwords like transparency, explainability, non-discrimination, safety, privacy, accountability, oversight, humans in the loop, and societal and environmental wellbeing consistently arise. AI ethical guidelines are mostly developed by actors in the Global North and predominantly focus on the possibility of ethical AI software, while the ethical pitfalls of AI's material dimensions remain largely overlooked.[26] When discussing workers' rights, for example, the software threats to workers in the Global North are usually considered—for example, privacy, surveillance, or job loss due to automation.[27] The debates on environmental wellbeing likewise risk overemphasising the software, for example, the enormous amounts of electricity needed to train machine learning algorithms.[28]

Thus, many important ethical issues remain overlooked in regulatory attempts. Since the Global South is indispensable in the genesis of AI in the very material sense of providing cheap labour and raw materials, decolonial scholars are well aware of the destruction left in the wake of the digitalisation of global economies. Some examples of this destruction recorded in their work are discussed in the fourth section of this article. Decolonial scholars are vocal in assessing the indifference of leading AI designers and regulators to human and nonhuman life in the Global South. Yet, their work, just like the issues of the Global South, often remains overlooked. It must be stressed that the Global North versus Global South terminology presents yet another deceiving and oversimplifying binary that demands some unpacking. Both Global North and South are heterogeneous. Nevertheless, as political and economic power largely remains concentrated in the countries of the Global North, the Global South remains exploited, mar-

23 Carmel & Paul, 2022.

24 Wu 2022; Roberts *et al.*, 2021.

25 Jobin, Ienca & Vayena, 2019.

26 Ricaurte, 2022; Crawford, 2021, pp. 223–227.

27 Cf. Rodrigues, 2020.

28 Cf. Strubell Ganesh & McCallum, 2019.

ginalised, racialised, and overlooked. That said, it is essential to avoid replicating the stale image of the underdeveloped poor South versus the rich, injustice-free North. When using this dualist distinction, it is imperative to be aware of its limitations and stress the overwhelming complexity of the situation worldwide, and the existence of economic Souths in the geographical North and vice versa.[29]

The North-South distinction is nonetheless helpful in the context of contemporary or late capitalism, neoliberalism, or technocapitalism—or whatever one wishes to call it.[30] I employ North-South terminology to stress that the current global economic and political system cannot function without extractivism and othering, or, in other words, cannot operate without the good old colonialist and patriarchal patterns. This reality is reflected in regulatory and ethics debates surrounding AI technologies. Contemporary capitalism is a system built and dependent upon endless economic growth and consumption, reducing people and the environment to expendable resources.[31] To entice the consumer in the Global North with the myths of clean and green technology, for example, the economic Souths must be kept far from view and discussion. Omitting the role and backstory of hardware in the everyday glorification of AI software is thus vital for the patterns of domination and extraction to remain undisturbed.

Our turbulent time, designated by Achille Mbembe as a time of planetary entanglement of fast capitalism, soft power warfare, and overflow of computational technologies, is not without history.[32] Capitalism as a political and economic system could not come to be and function without colonialism—the European occupation and exploitation of the globe that began in the fifteenth century.[33] As Walter Mignolo argues, Western modernity is unimaginable without coloniality, an intricate matrix of power that snakes from the Renaissance and Enlightenment to contemporary neoliberalism.[34] As the system of dispossession and unequal redistribution of costs and profits continues in capi-

[29] Png, 2022.

[30] It is not my intention to engage in a profound analysis of naming the present stage of global capitalism: this article engages with capitalism in the broadest sense of the word, that is, capitalism as a political and economic order and ideology. As AI technology and its implications for human (and other) rights are at the forefront of the discussion, technocapitalism is especially fitting. Technocapitalism is Suarez-Villa's denominator for contemporary capitalism in which technology and science facilitate a range of transformations of (corporate) power. See: Suarez-Villa, 2009, pp. 1–7; Neoliberalism as the signifier of contemporary capitalist practices is also fitting. Neoliberalism is defined by Harvey as a political and economic theory and practice that promotes entrepreneurial freedom, property rights, individual liberty, free trade, and free markets as the modes of advancing human well-being. See: Harvey, 2007.

[31] Jackson, 2021, pp. 1–161

[32] Mbembe, 2019, pp. 93–116.

[33] Bhambra, 2021.as formative of, and continuous with them. This is a consequence of the dominant understandings (across different theoretical perspectives

[34] Mignolo, 2011, pp. 1–26.

talism's techno-reincarnation, its racist and patriarchal underpinnings remain firmly in place. Moreover, technological advances, including the latest blossoming of AI research and industry, contribute to ever-intensified and accelerated connections, redistributions of power, and incipience of new fantastical myths. The bond between colonialism and capitalism thus remains central to understanding the role and implications of AI technologies in the global landscape. Through centuries, capitalism has morphed and transformed, just like colonialism has; yet, the two remain essentially interwoven, mutually dependent, and co-constitutive.

The logic of coloniality is apparent in the debates on AI regulation, which mostly ignore the actual costs and effects of contemporary technologies. Today's Other tends to elude our view just like the Enlightenment's Other, who disappeared from lofty debates about the rights of men, natural equality, and freedom.[35] When it comes to the production of AI hardware, the communities and environments of the Global South are too often perceived as passive repositories of resources, as relatively inconsequential in the quest for ethical human-centred AI. If we seriously consider that the distinction between software and hardware is, to a large extent, artificial and obscuring, we might realise that some of the most pressing regulatory and ethical issues related to AI are not novel at all.

When considering the artificiality of the hardware-software distinction, it is imperative to keep in mind that the Global South is not just a synonym for hardware production but is also crucial in AI software development. Just like body and mind, hardware and software are not two separate eventualities. Since AI software receives a lot of attention, this article focuses on the hardware to highlight issues that too often remain in the background. The intention is not to present hardware issues as more pressing and consequential but to illuminate precisely the fact that software and hardware ought to be contemplated in conjunction. Therefore, my attempt to shift the focus from software to hardware also illustrates that such exercise is, ironically, impossible, as the two perpetually intertwine. A meaningful debate on AI (ethics and regulation) must consider AI technology in its entirety or risk losing a vital piece of the puzzle in understanding how and why AI might positively contribute to life on planet Earth, as well as how AI harms all life on the planet and jeopardises human rights, including the very right to life. Before engaging with the interplay of rights and AI systems' lifecycles, the following section expands on the theoretical framework of mind-body dualism crucial for illuminating the preference for software in many AI debates.

3. Mind-body problem

In the Western tradition, the body is perceived as the passive temple or even the prison of the active mind and has accordingly enjoyed a lower status in the onto-epistemological

[35] Robertson, 2005; Carey & Festa, 2009.

hierarchy. Mind-body dualism was firmly established in the Age of Enlightenment and cemented through centuries with serious consequences for marginalized groups of the population. Women, colonised people, people of colour, and others identified with the body and nature were long perceived as part of the material universe, that is, as passive, incapable of rational thought and institution-building, and were denied access to education and political participation.[36] Such onto-epistemic orientations and classifications of people were used to justify colonialism, cultural genocide, oppression of women, and racialised slavery and represent the foundations of modernity and global capitalism.[37] The great minds of the Enlightenment imagined the privileged subject of knowledge in power in their own image: a white, affluent, educated man identified with reason, creativity, curiosity, invention, entrepreneurship, and so on. Nowadays, along these lines, the Global North, enchanted with the service economy and techno-solutionism, quickly identifies AI software as an artificial mind with AI as a whole.

AI systems are constantly presented as artificial minds and continuously discussed in separation from AI hardware, the machine's body. However, just like traditional mind-body dualism, the software-hardware binary distorts our understanding of the phenomena and prioritises certain issues over others. Topics like AI replacing human workers, AI surveillance, privacy concerns, and discriminating AI systems are significant issues. And yet, issues like widespread destruction of the environment, displacement and impoverishment of communities, and child labour are paramount as well. Nevertheless, as they pertain to the materiality of the machine, they lack the aura of exciting novelty associated with AI technologies. Furthermore, these issues are not unique to AI technology but are the bitter leitmotif of global capitalism. While different initiatives to address human rights abuses in global supply chains exist, they address only the symptoms of an inherently problematic system, are wrought with issues, and are often inefficient.[38] AI technologies, as a part of the global political and economic regime, are entangled in the longstanding bricolage of inequalities and injustices that define global capitalism.

Despite the persistent mystification of AI as an intangible process, AI is very much embodied. AI is an assemblage of actions, interactions, relationships, matter, knowledge, and power. Much celebrated digitalisation of economies is unimaginable without extractivism—the forceful removal of raw materials and life from the earth's surface, extraction of labour needed to produce electronic devices, and extraction of personal data performed in turn by these devices.[39] Individual AI systems' supply chains are estimated to include tens of thousands of suppliers in over a hundred countries and take years

[36] See, e.g., Bray & Colebrook, 1998; Jenkins, 2005

[37] Walsh & Mignolo, 2018, pp. 177–210.

[38] Alamgir & Banerjee, 2019; Anner, 2020.

[39] Mezzadra & Neilson, 2017.

to approximately disentangle.[40] Even companies whose business model is built around ethically sourced and produced technological products can hardly guarantee more than "aiming to work towards responsible natural resource management."[41] Therefore, it is, put mildly, challenging to ensure that the machines facilitating our relationships with AI software are ethical and free from contaminants like child labour, forced labour, conflict, destruction of habitats, and displacement. Furthermore, the AI industry contributes its fair share to global climate change, which represents another significant threat to human rights and the rights of other inhabitants of the planet.

The full-scale environmental impacts of AI technologies and their contributions to climate change are seldom considered.[42] The environmental burdens caused by the AI industry are unequally distributed between the Global North and South, as well as between economic Norths and Souths.[43] The poor, marginalised, and racialised communities worldwide consume the least but are more adversely affected by the degradation of the environment and climate change-related weather events and are more likely to struggle to access basic provisions such as clean drinking water.[44] The story of how the AI bodies/objects come to be, what it takes for these machines to operate, and what happens to them when they no longer serve us remains clouded by user ignorance and indifference. Nevertheless, this backstage process is crucial for understanding how AI intertwines with the present, future, and rights of human and nonhuman beings around the globe. The following section is composed of just a few examples that illustrate the wide array of ethical and legal issues that arise throughout the lifecycle of an AI system.

4. (Im)material AI?

4.1. Inception: Sweat and Minerals

AI, as we know it, would be impossible without an array of metals, minerals, and rare earth elements. Deposits of critical raw materials are scattered all over the globe. They are often subject to intense (geo)political frictions and competition between the traditional global economic powers of the Global North and those on the rise, most notably China.[45] The electricity-powered digital economy, with AI at its centre, is propagated as a pathway to a sustainable future, prompting both nation-states and corporations to

40 Crawford & Joler, 2018.

41 Fairphone, 2022.

42 Mulligan & Elaluf-Calderwood, 2022.

43 Islam & Winkel, 2017.

44 Bell, 2019.

45 Kalantzakos, 2019.

entertain ideas such as space mining to ensure the materials needed to enact this vision.[46] Perhaps even more immanent is the desire for large-scale deep-seabed mining, which will bring about unimaginable consequences for the little-understood ecosystems of the deep seas and the planet in general.[47] Nevertheless, the traditional forms of mineral extraction remain the norm across the world, from the lithium triangle in Bolivia, Chile, and Argentina to mass-scale production of rare-earth metals in China, from the goldmines in Australia and the USA to zinc mining in India. From the perspective of the Global South, streams of minerals and data flowing to the Global North are often unilateral: pouring from economically and politically weaker countries to those more powerful.

Extraction of materials like copper, gold, silver, aluminium, nickel, manganese, graphite, silver, lithium, cobalt, europium, terbium, and many others composing AI and other hardware takes place around the planet, often in politically and economically fragile countries. Large-scale mining is conducted chiefly by transnational corporations and does not economically benefit the communities residing in the mining areas. To survive, these communities are often forced to engage in extremely dangerous small-scale artisanal mining in the proximity of official mines. Due to its unofficial character, criminal groups often abuse artisanal mining, which is thus associated with conflict, violence, and exploitation.[48] Whether artisanal or corporate, extraction of minerals is perilous for human health, devastating for ecosystems, and water-intensive, contributing to wide-scale pollution and water scarcity.[49] As individual devices are compounded by a vast array of chemical elements extracted worldwide, the following lines provide only an illustrative example of cobalt extraction in the Democratic Republic of the Congo (DRC).

Climate change prompted demands for the abandonment of fossil fuels, yet the world order is organised around extreme consumption by privileged consumers, mostly residing in the Global North. This type of consumer wants it all: the comforts and vices of a privileged consumerist lifestyle, clean air, and green spaces in their immediate surroundings. This context is ripe for a greenwashing campaign presenting electricity as an ecologically friendly alternative to oil and coal, despite the fact that coal remains the dominant fuel used in global electricity production.[50] Moreover, electricity is not only problematic because it is often produced with a high carbon footprint; the issue of electricity storage is also highly contentious. The demand for rechargeable and relatively short-lived lithium-ion batteries is growing, and their production is impossible without minerals whose extraction poses several ethical and legal issues.[51]

46 Gilbert, 2021.

47 Levin, Amon & Lily, 2020.

48 Kaufmann & Côte, 2021.

49 Peña & Tapia, 2020.

50 International Energy Agency, 2022.

51 Crundwell, du Preez & Knights, 2020.

Cobalt, along with lithium, is one of the most notorious elements involved in this process, and its extraction is rapidly increasing. Cobalt, found in the battery of every (smart) device, is considered a critical raw mineral crucial in the transition to electricity-powered societies. The DRC and Zambia, the so-called Copperbelt, are home to the world's largest cobalt deposits. The DRC, a former Belgian colony, has a long history of extraction of copper, cobalt, and uranium for export. Today, the DRC produces almost 70% of the world's cobalt, 20–30% of which is extracted in artisanal mines.[52] Human rights abuses in cobalt mining in the DRC were brought into the limelight by the 2016 Amnesty International report[53] and the unsuccessful 2019 class lawsuit against Tesla, Apple, Google, and Microsoft, filed in the USA by the families of children killed or injured while mining cobalt.[54]

Harsh working conditions, child labour, and forced labour in artisanal mines contributed to the big mining companies' formalisation of unofficial mining operations. These moves, however, led to novel forms of dispossession and exploitation and did not provide safety for the miners.[55] Cobalt extraction is not only problematic from the perspective of exploitation of official and unofficial workers, widespread corruption, and conflict risks, but it also causes widespread environmental contamination. The health of those residing near cobalt mines is severely affected, and the rates of congenital disorders are alarmingly high.[56] As in the days of Belgium's colonisation, cobalt extracted in the DRC allows for the bare survival of local communities who bear the poisonous costs of the North's green transition, while the added value of the mineral is cashed in by corporations based in countries like the USA and China. The issues entangling cobalt production and the division of costs and profits of these operations are not unique to the DRC. Around the globe, communities are exploited, displaced, and harmed by mining operations that make AI technology possible.

4.2. Flux: Voyages and Transformations

Once raw materials are extracted, they travel to the many production facilities, where they are turned into diverse components, which travel to yet another set of production facilities where machines are constructed. Finished devices take another journey to reach their users, and once disposed of, they take their final voyage. This simplified description captures the essence of contemporary supply chains—where a single product repeatedly travels by sea, earth, and land and encompasses the labour of thousands. The transport

52 Calvão Mcdonald & Bolay, 2021; Gulley, 2022.

53 Amnesty International, 2016.

54 Mining.com, 2021.

55 Calvão Mcdonald & Bolay, 2021.

56 Van Brusselen *et al.*, 2020.

involved in the supply chains heavily contributes to climate change and is simultaneously threatened by the increasing frequency and ferocity of extreme weather events.[57] Much transportation is carried out by ships using dizzying quantities of low-grade fuel, polluting the air and the oceans and contributing to an estimated 60,000 deaths worldwide.[58] Millions of standardised containers roaming around the globe represent the basic building blocks of the global capitalist economy.

Hundreds of shipping containers are lost at sea every year, and the World Shipping Council reports a dramatic increase in lost containers observed in the years 2020 and 2021 due to weather events.[59] Many of these containers emit toxins and litter seabeds and seashores. Furthermore, seafaring is a highly hazardous occupation. Workers employed in the shipping industry spend long periods in relative isolation, are vulnerable to a high risk of (fatal) injury and physical and psychological illness, and are exposed to carcinogenic and other toxic materials.[60] The shipping industry is involved in all spheres of consumption and is not essential only in manufacturing AI hardware. Nevertheless, since AI technology has yet to assist in producing self-driving and self-loading ecologically friendly means of transportation, its development hinges on these harmful practices.

Let's entertain the workers' health, well-being, and survival for a moment longer. Psychological distress and high suicide rates among seafarers are not isolated; taking one's own life might even be a radical means of protest against exploitation. A series of jumping suicides of young migrant workers in Foxconn factories in Shenzhen, China, occurred between 2010 and 2011. In China, the Foxconn suicides were followed by a broader wave of worker suicides, as well as a public debate on labour conditions and factory management in the country.[61] Meagrely paid workers producing Apple and other devices described illegally long working hours, abuse, discrimination, and failure to report work-related accidents. The suicides highlighted the inequalities (re)produced in China's neoliberal economic blossoming and the state's complicity in this process.[62]

As a response to accusations that its operation is basically a labour camp, Foxconn installed anti-jumping nets[63] and included no-suicide clauses in the workers' contracts.[64] The worker suicides shocked the world and (momentarily) brought some attention to the exploitation of labour in producing electronic devices. The reader has undoubtedly already realised that the story of the Foxconn suicides is meant to illustrate a much broader

57 Ghadge Wurtmann & Seuring, 2020.
58 Crawford & Joler, 2018.
59 World Shipping Council, 2022.
60 Bloor Thomas & Lane, 2000.
61 Lin, Lin & Tseng, 2016.
62 Pun & Koo, 2015.
63 Ye, 2010.
64 Lee, 2011.

issue. Cheap factory labour is another prerequisite of AI technology since individual users, corporations, and research facilities demand sophisticated hardware at affordable prices. Despite alarmist discourse on robots and AI replacing human workers, cheap human labour seems to be, for the time being at least, essential in creating the machine.

4.3. Data: Ghosts and Clouds

While data might, at first glance, appear abstract and immaterial, it is a product and a resource driving the accumulation of capital by powerful actors in technocapitalist societies. Data extraction is another form of raw material extraction that involves dispossession, asymmetries of power, and colonialist techniques. Diverse, often vulnerable, populations around the globe—for example, users of social networks, workers in Amazon's fulfilment centres, people with criminal records—are at the forefront of data extraction that does not benefit them and might, in fact, adversely affect their well-being.[65] Users of seemingly free technological products are not compensated for the time and data that are essential for the functioning of Big Tech as we know it. Furthermore, the data-centric rationality at the heart of AI ideology also has colonial-flavoured epistemic dimensions, imposing dominant epistemological positions as universal modes of knowing at the expense of others.[66] Data is, moreover, very material: it must be stored in physical locations and processed by human beings to serve its assigned role in the system.

More and more data are stored and processed in the cloud. Despite its ethereal name, cloud computing implies massive data centres—factories offering on-demand paid delivery of information technology resources such as computing power, data storage, processing, and distribution on remote computers. The transition to cloud computing is a transition towards centralisation and commodification of the internet that was once imagined as free and decentralised cyberspace.[67] Cloud computing also raises issues connected with data security and the surveillance of technology users.[68] Moreover, data centres worldwide are big consumers of electricity for functioning and water for cooling the numerous computers. Thus, clouds can put public infrastructure and the environment under strain. Furthermore, cloud computing, essential for contemporary AI and digital technologies, does not burden the environment only through its consumption of resources. Greenpeace 2020 report details the role of cloud computing and AI tools offered by Google, Microsoft, and Amazon in facilitating and optimising the discovery, extraction, distribution, refining, and marketing of oil and gas.[69] As such, cloud computing sits

[65] Crawford, 2021, pp. 89–121; Delfanti & Frey, 2021.

[66] Ricaurte, 2019.

[67] Mosco, 2016.

[68] Rachana *et al.*, 2017.

[69] Greenpeace, 2020.

at the intersection of several ethical preoccupations concerning data, natural resources, and labour extraction.

Data is crucial for AI systems to "learn." Yet some tasks resist automation, and machine learning is not as spontaneous as it is made out to be. For the most part, machine learning and deep learning are supervised, meaning that human agents must label datasets used in the process in advance, adjust learning parameters, and so on. All internet users get to participate in this process, for instance, by improving AI machine vision each time we are asked to prove our humanity by clicking the correct images in Google's reCAPTCHA.[70] Yet, most of this work—and other work crucial for developing and functioning of AI systems—is performed by click-workers who remain invisible to an ordinary user.

These "ghost workers" are often employed through crowd-work platforms and meagrely paid by the click.[71] This is best exemplified by the cynical irony of Amazon's Mechanical Turk, a crowdsourcing marketplace where such a fragmented precarious workforce can be outsourced. Mechanical Turk mimics AI by delegating micro-work—such as like labelling, checking, assessing, and correcting machine-learning processes—to human workers around the globe. The very name of the platform originates from an eighteenth-century anecdote about a chess-playing automaton built to impress the Habsburg Empress Maria Theresa.[72] While the device appeared autonomous, it was actually just a casing hiding a human being operating it, creating an illusion of an intelligent machine. Platforms like Mechanical Turk created a digital global on-demand workforce working on their personal devices in their homes or internet cafés. This hyper-flexible precariat reflects colonialist and patriarchal structures at the heart of AI development, as many click-workers reside in the Global South.[73] Furthermore, many click-workers are women who struggle to find more traditional forms of employment because of their role as caretakers.[74] The relative invisibility of these shadow or ghost workers, predominantly vulnerable population groups, is once again veiled by the mythology of self-learning pumping much of the AI-related hype.

People who are more likely to be excluded from the creative and visible jobs in AI software design due to their economic status, place of birth/residence, race, gender, and other (intersections of) markers of oppression are not only more likely to perform invisible labour but also more likely to be the subjects of experimentation with newly developed AI systems. The hype surrounding AI allows tech companies to test their products on the general public around the world.[75] Yet again, some groups—namely,

70 Lung, 2012.

71 Gray & Suri, 2019, pp. ix–xxxi.

72 Aytes, 2013.

73 Soriano, Cabalquinto & Panaligan, 2021.

74 Altenried, 2020.

75 Stilgoe, 2018; Wolf, Miller & Grodzinsky, 2017.

those residing in the Global South and economic Souths in the Global North—are more vulnerable to the ethics dumping involved in AI systems' beta testing. For instance, the infamous Cambridge Analytica software was beta tested in Nigeria and Kenya elections before it was used in the United Kingdom (UK) and the USA; and New Zealand tested its predictive welfare algorithms on the Māori population.[76] This short overview of data extraction, processing, and epistemology illustrates the internal contradictions destabilising the mind-body dualism and their second coming in the software-hardware distinction. Data, like many key concepts of contemporary technologies, has been built up as the intangible new oil, despite the fact that it rests on the 'old' oil and human bodies that make it intelligible.

4.4. Necropolitics: E-waste and Wasted Lives

As digitalisation advances, the lifespan of electronic devices is becoming shorter and shorter while the demand for such devices is snowballing around the world. E-waste, an umbrella term for various discarded electronic equipment, is, therefore, a growing challenge. It is estimated that humanity produces e-waste equivalent to around 5,000 Eiffel towers in weight every year, which makes e-waste an environmental and health concern of epic proportions.[77] Simultaneously, one person's trash is another's treasure: e-waste recycling is an expanding multi-billion global industry.[78] Trash and treasure are liminal concepts in this context, as their disentanglement involves confronting an array of complexities. E-waste is essentially a bundle of plastics, gold, silver, copper, aluminium, platinum, nickel, chromium, zinc, mercury, beryllium, lead, and many other elements. Only an estimated 17% of this waste is properly collected and formally recycled.[79] The fate of the remaining global e-waste is unclear, probably decided outside the official collection systems. A portion of this e-waste is illegally shipped to and informally recycled in Africa and Asia, using methods like open burning and acid stripping of metals, which release an array of toxins.[80]

The way e- and other waste is handled today is, in part, connected with the environmental justice struggles that emerged in the Global North in the 1970s and 80s and inadvertently contributed to the exportation of hazardous waste to the Global South.[81] Recycling is usually understood as a positive practice that magically annihilates the negative contributions of hyper-consumption, yet the grim reality of (e-waste) recycling

[76] Mohamed, Png & Isaac, 2020.

[77] Parajuly *et al.*, 2019.

[78] Kaza *et al.*, 2018.

[79] Forti *et al.*, 2020.

[80] Rautela *et al.*, 2021.

[81] Little, 2021, pp. 16–21.

paints a less romantic picture. One of the infamous examples of the dark side of e-waste recycling is Agbogbloshie, a scrapyard with an adjoining informal settlement in Accra, Ghana. This formerly sacred place and green space for residents has gradually transformed into what is often depicted as a toxic high-tech hellscape,[82] where an egg exceeds the European Food Safety Authority limits for chlorinated dioxin's daily intake by 220-fold.[83] Agbogbloshie has attracted the attention of media, photographers, researchers, and NGOs, culminating in research fatigue among its workers and residents.[84] Most of the e-waste in this scrapyard originates in the EU and the USA, while some of it is created in Ghana and other African countries.[85] Reducing the site to a dead zone and a dead-end of green narratives would flatten down the complexity of activities, relationships, and struggles that define Agbogbloshie. Extraction of copper and aluminium from e-waste and refurbishing discarded digital devices for further use are important economic activities weaving the complex social fabric. Yet Agbogbloshie residents are undoubtedly burdened by the personal and ecological costs of the unsustainable habits of people residing in the Global North.

Agbogbloshie and other e-waste dumps function as powerful illustrations of a social, political, and economic system that favours software over hardware, new over old, central over peripheral, rich over poor, and capital over labour. In this system, the emergence of countless e-dumps is unavoidable. Still, as long as they remain out of sight of the privileged populations, the e-dumps remain largely ignored. The throw-away culture at the heart of our economic model and its concept of economic progress is not only creating e- and other waste but is also persistently expanding the wastelands that make human lives increasingly difficult and put them at risk. In this process of displacement, not only are discarded items produced, but also countless "wasted lives" or "human waste", to borrow Zygmunt Bauman's term for human beings deemed excessive, redundant, and threatening in the prevailing model of economic progress and modernisation.[86] The e-dumps thus symbolise not only the pivotal point where the lifecycle of one machine ends to discharge materials for a new one but also the wasted lives, stolen childhoods, opportunities, and living spaces of those unable to afford the latest electronic devices.

These wasted lives inspire dread in the Global North: no wonder the EU, with all its talk about ethical and human-centred AI, feels little reservation when protecting its "smart borders" with invasive AI technologies targeting third-country nationals.[87] Again, the human being around which technology and rights are built is the EU citizen, a user

82 Little & Akese, 2019.

83 Petrlik et al., 2019.

84 Akese, 2020.

85 Little & Akese, 2019.

86 Bauman, 2013, pp. 1–41.

87 Jo Pesch, Dimitrova & Boehm, 2022; Broeders & Hampshire, 2013.

and consumer in need of protection from not only invasive AI technologies but also from human waste in the form of desolate migrants fleeing poverty, despair, drought, floods, toxicity, and other by-products of the capitalist system. This human waste is another class of subjectivity whose rights weigh less than those of the users for whom EU legislation is drafted. In late capitalism, as before, colonial sovereignty encompasses the power to define who matters and who is disposable.[88] Thus, an e-dump is far from the final chapter of an AI hardware's lifespan; it is but a repetition of the omnipresent re-establishing of borders, a site of what Mbembe terms "necropolitics", the drawing of the border between humans who get to live and those designated to social death, an expulsion from humanity and its rights.[89]

The concrete examples discussed above are far too few to highlight the full scale of global destruction necessary to support the AI industry as we know it. Furthermore, the above descriptions are too loose and general to expose the full range of human and non-human beings affected and the full gravity and complexity of their stories. Nevertheless, these partial stories indicate that humans are all too present in the AI loop and that the related ethical issues cannot be ignored or excluded from the AI regulation debate, even if they are not AI (software) issues *stricto sensu*.

5. Conclusions

Systemic critique of the excessive focus on AI software in scholarly and regulatory debates carried out in this article strategically shifts the focus to AI hardware. At first glance, the software-hardware distinction appears to be a simple and logical epistemic binary, dividing programming and mechanical engineering. Yet, there is a political dimension to this dualism: it allows us to ignore the continuation of colonial patterns that define capitalism as a political and economic system. Technocapitalism and the obsession with data, the service economy, and digitalisation, are no exceptions: "postindustrial" societies rely on extractivism and the industrialisation of the peripheries. The prioritization of software over hardware thus reflects a system prioritising capital over labour and (surveilled and exploited) users over (surveilled and exploited) producers.

AI hardware is not essentially different from computer hardware without an "intelligent" dimension. Furthermore, from the point of view of hardware production, transportation, and waste management, AI is not essentially different from all other objects circulating in the global economy, like clothing, food, furniture, or toys. The exploitation of the Global South for the profits created in the Global North is a longstanding process and the foundation of the global capitalist political and economic order. Human rights, including the right to life, are all too often side-lined in relation to capital expansion and

[88] Mbembe, 2019, pp. 78–83.

[89] *Ibid.*

economic growth. Since so much debate focuses on what makes AI technology special and different from all other phenomena, this article highlights what makes AI technologies painfully familiar. Rejecting the glorification of AI software entails understanding AI as a paradigm of technocapitalism and inadvertently broadening its definition beyond advanced statistical models involving some kind of machine "learning" or "training" ability.

Despite the focus on hardware, this article does not claim that hardware issues are more important than software issues. The attempt to overturn the binary—that is, to isolate and highlight the hardware aspect, if only to demonstrate that it has been side-lined and devalued *vis-à-vis* software—is self-deconstructing from the get-go. Neither software nor hardware can be treated in isolation, nor can one of these aspects be considered more important in defining AI. The examples provided throughout this article illustrate precisely the hopeless entanglement of human rights issues that define AI as hardware/software. What the overturning of the binary achieves is precisely what feminist, critical race, and decolonial critics of mind-body onto-epistemic dualism continuously assert. Identifying the privileged pole of a hierarchical binary (mind, software) with that which is creative, interesting, and thus worthy of attention erases and depreciates the opposite pole (body, hardware). The resulting injury is multi-dimensional. First, it creates an illusion that the separation of the two poles is possible and simple, while the dualism is always somewhat artificial, as its two poles endlessly contaminate one another. Second, the devaluated pole (body, hardware) is systematically ignored as the passive prerequisite of the active and creative pole (mind, software).

In the case of AI, this means that AI software and its creators—the computer software engineers and tech entrepreneurs—are celebrated as creative, revolutionary explorers of uncharted lands. The harm caused by the hardware industry and the contribution of human beings who perform non-programming labour is subsequently erased from the majority of AI discussions. Dualistic perception of software and hardware thus enables a privileged and highly homogenous group of human beings to reap enormous rewards for what is essentially a common undertaking, all the while huge costs are borne by the planet and all its inhabitants. In other words, AI mythologies forget about the hardware, the body, treating it as a given, necessary but passive and taken-for-granted machine that hosts the active and amazing mind, the software. AI understood as software/hardware, on the other hand, robs the AI phenomenon of its exceptionality. Instead, approaching AI as hardware/software places AI in the broader context of contemporary technology and an even broader context of hyper-consumerism fuelling the global economy. What is lost through this operation is the hype, and what is gained is a more sober reckoning with the challenges of tomorrow.

AI as software/hardware invites consideration that the threats to fundamental rights caused by AI software are hopelessly entangled with those posed by AI hardware. Transparent and fair AI cannot be a product of colonial displacement, dispossession,

and ecocide. Instead of endless proliferation, a sustainable AI industry mindful of human rights inescapably implies fewer and more expensive, repairable, and long-lasting technological products. Technological interventions should be guided not by corporate greed and the (perceived) privileged users' desires but by the actual needs of humanity as a whole and with a sensibility for the needs of nonhuman entities. The speed of development of new technologies and beta testing should be slowed down and subjected to peer review, rigorous scientific ethics, and public regulation. Sustainable and human-centred technology also requires rethinking techno-solutionist narratives, which suggest that technology can solve our problems without sacrificing the privilege and unsustainable way of life that we, the inhabitants of the Norths of this world, consider as our entitlement.

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