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TECHNOLOGY AND ENVIRONMENT: REFLECTIONS ON THE GLOBAL RELEVANCE OF A HISTORICAL AND CONCEPTUAL NEXUS

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Abstract: This contribution engages with recent scholarship on technology, environment, Big Data and Artificial Intelligence that have highlighted their manyfold historical, political and conceptual entanglements on a global scale. These include the way technologies over time have contributed to shape the human and natural environment; how they are changing political and scientific representations of the environment and of its transformations; the ecological costs of contemporary capitalism that exploits data and largely relies on digital technologies. Through this survey of texts and theories – mainly advanced by scholars at the Divison of History, Science, Technology and Environment of the Kth Royal Institute of Technology in Stockholm, Sweden – this contribution aims at pointing at the major strands of critical understanding of contemporary digital technologies from a global and ecologist point of view, also in order to highlight some of their theoretical further possible developments.

Keywords: technology, environment, Artificial Intelligence, critical theory, Anthropocene.

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TWO CONCEPTS, ONE HISTORY

This paper offers a critical review of the most recent scholarship on technology, environment, Big Data and Artificial Intelligence that have highlighted their manyfold historical, political and conceptual entanglements on a global scale. These include the way technologies over time have contributed to shape the human and natural environment; how they are changing political and scientific representations of the environment and of its transformations; the ecological costs of contemporary capitalism that exploits data and largely relies on digital technologies. Through this survey of texts recently published – mainly advanced by scholars at the Divison of History, Science, Technology and Environment of the Kth Royal Institute of Technology in Stockholm, Sweden – this contribution aims at pointing at the major strands of critical understanding of contemporary digital technologies from a global and ecologist point of view, also in order to highlight some of their theoretical further possible developments.

It is not possible to provide an unambiguous definition of either technology or environment. The two terms were assigned their modern meaning between the end of the 18th century and the beginning of the 19th century. In particular, German cameralists made "technology" a crucial discipline of government; "environment", on the other hand, started naming a set of meaningful conditions for the preservation and modification of living organisms over time in 1809, when French naturalist Jean-Baptiste Lamarck published his influential volume *Philosophie zoologique* (Barsanti 1979; Frison 1993; Benson 2020; Consolati 2022). Since then, both terms have been subjected to countless tensions and scientific redefinitions, making the historical investigation of the concepts of technology and environment as complex as it is urgent today (Schatzberg 2018; Warde, Robin, Sorlin 2021). Prominent scholars at the Divison of History, Science, Technology and Environment of the Kth Royal Institute of Technology in Stockholm, Sweden, have been engaged in the last years precisely in the study of the historical and conceptual nexus between "technology" and "environment" in order to come to a critical and theoretical understanding of

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their interplay in our global present. Key recent researches they have published are worth to be discussed inasmuch as they represent an original attempt to historicize the contemporary topicality of ecology and technology both for social disciplines, and for global governance. In doing so, this field of investigation allows to grasp not only the historical and conceptual nexus between "technology" and "environment", but also the way both concepts have become crucial references for contemporary global politics.

What is to be gained from the theoretical attempt to consider the history of "technology" and of "environment" both as closely interlinked, and affecting each other? The answer which emerges from the seminal work published by Sverker Sörlin and Nina Wormbs in 2018 breaks both with the idea that the ecological crisis is an unprecedented process, disconnected with previous human history, and with the narrow alternative between techno-optimism and techno-pessimism; i.e., with the tendency to consider technology either as a cause or a solution to environmental problems, rather than as part of their history (Sörlin, Wormbs 2018). Thinking in terms of "environing technologies" – this is the formula chosen by the authors to express the material and conceptual connection between "technology" and "environment" – means posing the problem of how the environment has been historically affected by processes of production and social reproduction: it implies to assess technology not as a mere set of technical objects, but as a means of getting to know and to change the world, thus "building" the environment as a technological representation "of the material world in which humans and their actions are embedded" (Sörlin, Wormbs 2018: 103).

As the two authors make it clear a few pages later, "when technology has been related to environment, it has been to suggest that certain technologies create environmental problems, or in certain instances help solve such problems. This underscores a deep divide […]. We argue instead that putting them together can shed light on the practices whereby humans make environments" (Sörlin, Wormbs 2018: 106). This change of perspective on the historicization of "technology" and "environment" is a programmatic statement which the authors and

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many of their colleagues at the Kth have been following since then. The assumption from which they move is the "importance of historicizing the human-Earth relationship", because only such attempt can help framing both the contemporary challenge represented by the ecological crisis, and "how human societies can change to take care of it better" (Sörlin, Wormbs 2018: 117). This opens up a field of social and historical research on how technologies have mediated our understanding of the Planet, thus materially affecting its political government.

REPRESENTATION, MEDIATION, DATAFICATION

This is the specific topic of a collective paper published in 2024 on the influential journal *Environmental Science and Policy* (Wickberg et al. 2024). The authors, all part of the Division of History, Science, Technology and Environment at Kth, recognize the unprecedented capacities of mathematical modeling of environmental processes opened up by the availability of Big Data and by the possibility of producing appropriate correlations between them through Artificial Intelligence; at the same time, they claim that this has historical roots in at least the 20th century (Chun 2015). As they state: "over the past half century, the global environment has been subjected to an accelerated pace of technological mediation and datafication, so that in the present, knowledge and governance of Earth systems depend on enormous flows of data from a 'vast machine' of measuring tools" (Wickberg et al. 2024: 1-2). A history of environmental datafication – which they thoroughly reconstruct in the paper – shows that we live in a "mediated planet"; i.e., how data are collected and what they pretend to describe is not a neutral process (Cukier, Meyer-Shönberger 2013; O'Neill 2017). By highlighting that big environmental data is mainly owned and operated by private Big Tech companies such as Google and Microsoft, and that global governance largely relies on them, it becomes clear that this is not just an ethical issue, but also a scientific and political one. Owning environmental databases means having the power to choose which aspects of the climate crisis to represent, thus producing a global image of which political

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measures should be taken urgently, and which not, which subjects should be entitled to enforce them, and who should pay for their social and economic costs. The authors refer to this dynamic as "data inequity" and suggest that it is one of the main reasons why significant differences in institutional climate action around the world are still a matter of dispute for ecological movements and national and international institutions. Notably, this helps shifting the focus from the mere recognition that private data lack transparency, towards a critical assessment of the political and economic interests that are legitimized through their production, collection, storage, and sale.

By representing complex and stratified ecological processes with simple figures and tables, what digital technologies and data do is also to make it possible to have a grasp on environmental and climate phenomena: they make them plausible objects of government and capitalist exploitation first of all by making them intelligible. So, to historicize this key issue in global governance and capitalism allows to establish a critical and theoretical nexus between technology and environment, which was part of the research goals of this group of scholars at least since 2018. Today, this historical entanglement is radically reconfigured by Artificial Intelligence: not only most part of the scholarship on the topic limit itself to take side either in favour or against the application of AI systems to the solution of climate issues, but the alleged 'immateriality' of digital technologies makes it more difficult to establish a critical link between them and environmental deterioration (Moore 2023). "Digital technology, while often perceived as a tool for sustainability with comparatively smaller impact than non-digital counterparts, relies on a material planetary infrastructure of resources, and requires copious energy use and physical connectivity. […] In other words, the rapid scaling up of environmental datafication not only coincides with but is integral to the ongoing ecological crisis" (Wickberg et al. 2024: 4).

Critical scholarship on AI is consistently showing its material costs in terms of resources and labour exploitation; this is the first step for an ecologist critique of AI. One more aspect that needs to be investigated is how the concept of technology

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itself is currently being redefined by contemporary developments of AI systems. Notably, a process of intense redefinition is also occurring to the concept of environment, especially within discourses on the "Anthropocene". This represents a further step forward in the attempt to critically assess current relations between science-informed understandings of the Earth-system, and the large-scale and pervasive datafication of the environment.

DOES ARTIFICIAL INTELLIGENCE CHANGE THE HISTORY OF THE ANTHROPOCENE?

Geologists and climate scientists have recently formally rejected the term "Anthropocene" to describe the new geological epoch into which humanity has supposedly entered (International Commission on Stratigraphy 2024). Despite this question of scientific nomenclature, the term has now established itself at the heart of historical, political and social studies of the climate crisis and its causes. As a consequence, anyone attempting to produce a critical theory of the Anthropocene today has to face the challenge of theoretically articulate the relationship between the obvious discontinuity introduced by the acceleration of catastrophic environmental processes and extreme climatic phenomena, and the historical continuity between the present and the past that generated it (Bonneuil, Fressoz 2013; Charbonnier 2020; Del Vecchio 2020; Missiroli 2022; Bonasera 2023). In this sense, it is worth looking at the historicity of the Anthropocene from the point of view of the relation between "technology" and "environment". Recently, this has been partially attempted by Kate Crawford, who has effectively shown the material dependance of AI systems on logistic networks, sites of extractions, labour exploitation and Earth's resources (Crawford, Joler 2018; Crawford 2021). In doing so, Crawford challenges the idea that Artificial Intelligence is something immaterial, detached from history and politics, demonstrating its strategic role in securing the resources and labour that capitalism relies on globally, as well as its political function in addressing the climate crisis.

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To establish in which measure AI and Big Data conceptually relate to the history of the Anthropocene is the topic of an essay published in 2023 by Adam Wickberg and Johan Gärdebo. By building on the concepts of "environing media" and "mediated planet", their aim is to "analyze how AI enters the field of knowing and doing a global environment", which also means to investigate which role technology plays in current political representations of the climate as an object of governmental and capitalistic regulation (Wickberg, Gärdebo 2023: 332). By elaborating on the idea that the history of AI is also a history of a specific growing knowledge to which multiple disciplinary fields – from computer science to cybernetics, statistics, psychology and many more – have contributed over time, the authors conclude that "AI constitutes the machine room of the Anthropocene – an essential part of the growing technosphere – and the history of that mechanical knowledge is a story about how we got to this place" (Wickberg, Gärdebo 2023: 338). The theoretical strategy pursued is as clear as it is effective: if "technology" and "environment" are historically and conceptually bounded to each other, contrasting the idea that AI and Big Data are a-historical and immaterial entities allows directly to contrast also the assumption that the climate crisis is a condition of complete novelty without internal differences, historical causes, and political heterogeneous effects. Again, as the authors clarify in the conclusions of their essay, "it is not only a matter of so-called historical context, but rather that forces from the past remain active in the present and continue to shape our future" (Wickberg, Gärdebo 2023: 342). To historicize the relation between "technology" and "environment" does not simply equal to showing the persistence over time of a specific configuration of that entanglement, but to open up the space for a critical and conceptual assessment of its role for present and future political transformations of societies. This stands as a topical remark which can work as a guideline for further research in the fields of the History of science, Global history, and Conceptual history interested in historically analyzing the political implications and effects of an AI-powered data-driven conception of the management of the Planet (De Luca 2024). The attempt brought forward in recent years at Kth is

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important as it traces relevant theoretical coordinates through which to investigate how "technology" and "environment" have established themselves as two historical and conceptual vectors for constructing a global image of the Planet that is both unified, and internally differentiated; to consider how a critical history of Artificial Intelligence cannot fail to address the continuities and discontinuities that criss-cross the longer history of "technology" and "environment"; to assess what historical and political nexus can be established between the market processes that shape contemporary capitalism, and the functioning of algorithms and artificial intelligence, which today globally redefine social and political relations (Rudan, Consolati 2024).

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