Harnessing Ethical AI Surveillance for Climate Change Governmentality

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Achieving sustainability in respect to the natural environment necessitates a changing paradigm in climate's governmentality, as to discipline complex modalities of techno-social agency that underlie the current climate crisis. From a transdisciplinary approach, the analysis recalls the science of climate change with the existing frame of international law (hard and soft law), analyzing the conditions for the accountability of organizations (Nations and corporations) in the production of anthropogenic emissions. Organizations are deciphered as complex techno-social systems of communication responding to reflexivity, feature that precludes them from understanding natural environment limitations. Reflexivity triggers carbon lock-in, a special form of path dependency at the base of the current schism between knowledge, intention, and actions. Reflexivity threatens long-term sustainability while endangering life and social systems. Artificial Intelligence can help overcome reflexivity, only if AI is restrained by an ethical approach constructed by the protection of human rights, the notion of environmental stewardship and the sustainability goals. Idealized ethical AI needs to take the form of hard law regulation.

Keywords: Governmentality of global warming, Reflexivity, Carbon majors' accountability, Ethical artificial intelligence, Philosophy of technology.

1 Introduction

This paper offers a scaffold for improving the governmentality of global warming, facilitating further studies on each of the problematic nodes it identifies. Climate governmentality is conceived as a wicked or complex problem, involving all levels of society and earth systems.

The notions of environmental resilience, complexity and sustainability are the conceptual nodes that set the background to address Climate governmentality. Considering the diverse perspectives involved in the topic, the notions take diverse significations. From the perspective of organizations and nation states, sustainability and resiliency relate to the conditions and the possibilities for continuing systemic operations. Resilience is the capacity of the organization to persevere when confronted with low probability/high impact events. Sustainability, in its turn, refers to the general environmental conditions that the organization needs to consider as to remain viable.

In contrast, from the perspective of humans affected by the climate crisis, resilience displays the need to recover when facing the consequences of climate change, notwithstanding trauma and uprooting. Sustainability in their perspective, involves the notion of planetary limits and considers economic, environmental and social aspects.

Complexity follows N. Luhmann's typology. Natural complexity is the one experienced by humanity facing the challenge of the natural world. As humanity faced the harsh conditions of the natural world, it developed social-technical systems to alleviate its effects. From the communications arising from social systems emerges a second type of complexity, derived complexity, which evolution challenges planetary boundaries.

Climate governmentality involves the socio-technical productions of the economy, the political system, health systems, among other partial systems of society, with the actions of national states, corporations and the level of humanity. Climate governmentality is multidisciplinary in nature, impacting all levels of society.

The analysis integrates the following sections:1. The Science. 2. Integrating scientific knowledge in the UN system. 3. The schism between declarations and actions 4. The actants. Organizations as social systems. 5. Carbon Majors. 6. The need for a paradigm change of the notion of governmentality. 7. Litigation. 8. The call for a second-level observer. An ethical Artificial Intelligence (EAI). 9. The features of EAI for helping climate governmentality. Time accelerator, universal translator and ubiquitous observer, superior calculator, and forecaster of future states. 10. Conclusions and Discussion.

2 Methodology

The analysis used a 'structured analytic technique'. It is a type of qualitative operational research specifically designed to approach complex problems. It seeks to develop a model of relevant factors, and of their interaction for ulterior decision-making. The approach was born as a reaction to analytical methodologies that could not apprehend complex, intertwined issues that first need to assess components and their interactions. The technique allows us to organize information and identify relevant drivers of a complex problem. This approach allows us to create a scaffold for spotting problematic nodes and their intersections.

After a widespread revision of the existing sources, the task was narrowed down to identifying the central problems considering enhancing the governmentality of climate change. Then, second order analysis prompted the revision of the legal structure and later on, the call for disciplining the behaviour of corporations and nation-states.

There, reflexivity is the crucial trait that blocks organizations from considering natural environment boundaries. There, complex systems analysis can reveal the ontological features that contribute to the veil of reflexivity of organizations. While the veil of reflexivity can be pierced by media of communication conveying excluded information to the attention of the system, for such information to be accounted for, it must be observed by a second-order agent. The analysis proposes Artificial Intelligence (AI) to enact this role of second-order observer and pierce the cognitive impediment of reflexivity in organizations. Since AI, in its turn, features reflexivity, it also needs to be disciplined. A legal framework for an EAI must include human rights protection, biosphere stewardship, and the millennium goals.

3 The Science

Rising Earth's temperature is caused by heat-trapping greenhouse gases of anthropogenic source, disrupting weather, life, and social systems, seeding a climate crisis that entails frequent extreme weather events. The transformation of natural systems in the atmosphere, ocean, cryosphere, and biosphere is caused by human action that began with the industrial era [1]. CO_2 atmospheric levels are currently around 40% above natural levels of CO_2 experienced over the last million years of Earth's history.

Earth developed a stasis in its carbon cycle, nurturing a variety of life forms. Rising temperatures disturb the conditions for the survival of existing life forms, breaking havoc not only with life systems but also societies [2].

The World Meteorological Organization (WMO) 2022 issued "State of the Global Climate", [3] exposing that crucial climate change indicators reached in 2021 alarming new records. The key notion here is interconnectedness, as the global climate indicators are closely interlinked and expose how an imbalance

in one, is closely followed by a disequilibrium in the others. A warming world disrupts all components of Earth's system, hampering efforts to attain the UN Sustainable Development Goals.[4].

Earth's climate is part of a complex, dynamical relationship of mutual feedback with other natural systems. The ocean interacts with earth systems [5] and because most of the excess heat from greenhouse gases is absorbed by the ocean, it is currently overheating. Ocean warming then leads to extreme weather events (EWE), and melting the portal ice shelves, disrupting marine ecosystems and weather systems. Follows a process of ocean acidification, that impacts ion availability for organisms to maintain their hard structures, distressing, among many others, shellfish, and corals. Those organisms are, in their turn, connected to the web of life of other species that need them to survive, including humans. This intricate network between natural systems underlies the severity of global warming effects. Indeed, the damage of global warming lies both in its magnitude and in the irreversibility of its effects. Irreversibility is the second notion to keep in mind. Linear processes can often be turned back to a previous state. In complex intertwined systems, the dial back is harder to attain, if such return to normality is even feasible. Ilya Prigogine studied irreversible processes, which are the source of dissipative structures: complex structures that emerge from chaotic states. Earth's delicate and fragile equilibrium of the atmosphere and warming gases is such a dissipative structure that nurtures life forms. The delicate balance supporting life is precipitously degrading.

4 Integrating Scientific Knowledge into International Law

The United Nations (UN) is the supranational institution managing the collective response to global warming. The UN system of international law (UNIL) originated after the second World War, accounting for the way of being expected from national states. UNIL, at this supranational level, displays distinct features: National states are bounded by their sovereign will when subscribing treaties, agreements, and conventions. The Vienna Convention on the Law of Treaties (1969) frames the conditions for nation states to fulfil the obligations that derive from subscribing a treaty or a convention. In strict sense, states are obligated by the wording and conditions inscribed in the agreement. Thus, if the agreement lacks agreed upon mechanisms for accountability, then the states cannot be compelled to fulfil their obligations.

Henceforth, UNIL system features two dynamic forms that favor international collective action. First, hard law mechanisms, that refer to legal obligations that are binding on the parties involved and that can be legally enforced before a court. Three criteria define whether a law fits the conditions to be considered as hard law: it must provide a binding obligation, be precisely worded and it has to offer some type of delegation in the implementation of the law. Second, and by exclusion, fragility in one of the three criteria define the domain of soft law. Soft law can present normative content while lacking precision, a clear obligation or delegation. As identified by Chinkin [6] treaties and agreements can be worded as to express the good faith of the subscriber while remaining devoid of binding commitments, as 'legal soft law'. The UN legal corpus falls under this description, and its status explains the failure in marshalling immediate action, notwithstanding the urgency of climate warming.

Even so, international governance can be seen as a process of increasing legalization. The UNIL is a nascent legal system that has not reached its autonomy. Seeing it as a process towards autonomous self-definition, some of the forms of the soft law can antecede the stabilization of legal standards and legal operations. Then, soft law that is today impotent by design, progresses in the path towards a future full-fledged legal supra-national system.

Seeing the urgency of climate change, the limitations of the UNIL system are glaring. In what follows we will briefly revise the problem of a system that is impotent by design, as the parties can withdraw from fulfilling commitments if they deem those commitments to contravene national interests.

The UN Framework Convention on Climate Change (FCCC) 1992 [7], ratified by 197 countries, seeks the "stabilization of greenhouse gas concentrations... at a level that would prevent dangerous anthropogenic interference with the climate system". The treaty recognizes the necessity to transform human activity harming weather systems, acknowledging both direct and indirect human activity "that

alters the composition of the global atmosphere, and which is in addition to natural climate variability. . . " (Article 1. Definitions 2.). The FCCC also established the Warsaw International Mechanism on Loss and Damage Associated with the Impacts of Climate Change (WIM) [8]. The mechanism advances the definition of loss and damage resulting from climate change [9], while lacking mandatory, quantified mitigation targets for individual countries, and mechanisms for demanding and effectuating accountability.

Pledging allegiance to the sovereign will of nations, the FCCC specifies that conflict must be solved by further negotiation between the parties. Thus, efficacy, as a measure of goals attained, is strictly limited. By the FCCC, the subscribing nations accept that in case of dispute they can a. Submit the dispute to the International Court of Justice and b. use Arbitration in accordance with procedures to be adopted by the Conference of the Parties as soon as practicable, in an annex on arbitration. At this date, the International Court of Justice (ICJ) has never produced an advisory ruling on the foundation of the UNFCCC and has been ineffectual. The FCCC lacks the coercive elements to enforce its objectives and remains impotent by design. [10].

After the FCCC came the Kyoto Protocol (1997) [11]. In terms of hard law, Kyoto displayed precise, binding national obligations to reduce emissions for each developed country party. Soft law components incentivized developing countries under the Clean Development Mechanism, allowing countries to sell certified emissions reduction credits to developed countries wishing to offset their domestic emissions. There was also a public funding mechanism in the Global Environment Facility, amongst other funding mechanisms.

Seeing their economies and national interests compromised by Kyoto, major parties rejected its provisions and hindered the emergent autonomy of a supranational legal system disciplining countries' behavior. In more concrete terms, the USA refused to ratify a binding treaty for mitigation obligations, while developing countries were unwilling to legally bind themselves to achieving mitigation targets [12].

Subsequently, a step forward in the process of evolving binding structures for climate governmentality took place with the Paris Agreement (2015) [13]. Paris included a precise collective goal and a legally binding framework for countries to present periodic national contributions (NDCs) and their review. Evaluation of advancement in reaching the goals set by the NDCs produced significant developments. Identification of policies and effects favors a 'transparency framework' that requests countries to report on national emissions and policies. Paris reached a crucial step in gathering information from national contributions. Nevertheless, Paris still lacks precision at the level of the obligations of the countries regarding detailed national contributions.

Another important aspect advancing the development of a supranational legal system for climate governmentality can be found in the integration of the science of global warming within the UN.

Since the creation of the IPCC 1988, the international community recognized that climate change was the result of human activities. Later, the Fifth Assessment Report (AR5) 2013, 2014[14] gave scientific input to the Paris Agreement. The IPCC is currently in its Sixth Assessment cycle, producing three Special Reports, a Methodology Report, and the Sixth Assessment Report. The first Special Report, Global Warming of 1.5°C (SR15) [15], was requested by world governments under the Paris Agreement. In 2019, the IPCC updated the 2006 IPCC Guidelines on National Greenhouse Gas Inventories [16]. The Special Report on Climate Change and Land (SRCCL) [17] and the Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC) [18] illustrated to policy makers and citizens on the causes, interactions and threats created by global warming. The recent reports of 2021 The Physical Science Basis [19] and 2022 Impacts, Adaptation and Vulnerability [20], enhance and deepen the clarity of the message reviewing the impacts of climate change on ecosystems, biodiversity, and human communities. The interconnectedness of the physics, the biological and the social is fundamental for assessing the necessity of urgent collective action, inscribed already within the UNIL system. The most recent report exposes the connection between;

(i) the physical aspects of global warming,

(ii) the impending danger for human health and social systems, and

(iii) sources of danger and UN millennium goals.

We can observe two distinct and contradictory communications overlapping within the structure of the UNIL. On the one hand, the science is speaking clearly and loudly, explaining in detail the causes and consequences of climate change at all levels of the global society, insisting on the impacts for Earth systems. On the other hand, the communications from national states are defined by a narrow view of economic growth and national interest. Both communications collide, while the time for collective action has never been more urgent.

5 The Schism between Declarations and Actions

The science is included within the UNIL system for climate governance. However, the system has been devised with the autonomy of States at its core, and as a result, it is impotent by design. The difficulty lies in the varied stance that legal agreements have, and in the resulting low level of accountability. The absence of a legal frame for exerting accountability produces a failure in governmentality. In its place, parties avoid moral blame by communicating symbolic and inefficient pledges.

The institutions of the UNIL are also incipient. The Security Council, (UNSC) is the only organ with a clear mandate to maintain international peace and security. While it acknowledges that climate change affects global stability, it has still not integrated climate crisis in its understanding of a security threat. As EWE proliferate, there are mounting signs of a push for increasing climate governmentality: In 202O, Germany led a Joint Initiative to Address Climate-Related Security Risks (Ten UNSC Member States, 2020) [21].

The 2021 Production Gap Report (PGR) [22] exposed governments' plans to produce more than double the amount of fossil fuels in 2030, contradicting their declarations and promises to limit global warming to 1.5 C. In 2022, fossil fuel amounts to the 75% of global emissions causing global warming. Furthermore, the latest emissions gap report from the United Nations Environment Program [23] underscores how current and planned mitigation measures fall short to achieve the goal of the Paris Agreement of limiting global warming to 1.5°C above preindustrial temperatures. The report uncovers that Nationally Determined Contributions (NDCs), along with other commitments, only take an additional 7.5% off predicted annual greenhouse gas emissions in 2030, compared to the previous round of commitments. In reality, reductions need to be of 55% to attain the goal of 1.5C.

The 2022 "Mitigation of Climate Change", Sixth Assessment report (AR6) integrated the flow of alarms, stressing the need to cut greenhouse emissions. Nevertheless, global fossil fuel emissions rebounded sharply (in 2021) back to the pre-pandemic levels. The report discloses a wide schism between the pledges of the countries and the current model for energy production and pathways to development.

In the production of anthropogenic emissions, states are deemed responsible for the emissions within their territories, but the emissions are also produced by substate entities, with actions juxtapose the ones of the national states and that, in the case of transnational corporations, go beyond the physical territories of the nations.

We can thus discern three overlapping layers in the making of the conundrum. First are the nation-states expected to behave according to the rules of international law. On the second layer are substate entities, such as cities and states, that can subscribe autonomous agreements to reach collective goals about climate objectives. The third layer is composed by transnational companies and corporations, that take flexible and wide-ranging forms. Companies and corporations can fit under the statutory and legal umbrella of the national state, or can develop outside of frontiers of nations, developing agreements that are ruled by the text of the contract or by international agreements.

The three layers interact with each other. National states develop general policies for energy production policies which, in turn, affect cities and states. Corporations produce energy, and are responsible for the release of anthropogenic gases into the atmosphere.

In addition, concomitant timeframes demand consideration. Natural systems experience a steep pressure for adaptation to global warming, for living entities time runs faster than their biological ability to change. For national governments, the temporality is multiple. Governments considers the time of the next

political election -in the case of democratic societies- and simultaneously, it responds to urgent needs from the communities suffering climate change. EWE can impel human displacement or hunger. Moreover, governments foremost need to consider the timeframe of the economy. Then, the needs of economic growth, or the continuity of economic operations subordinate to the timeframe of rising temperatures and their effects. Conflicting programs and distinct temporalities underlie the schism between declarations and actions.

6 The Actants. Organizations as Social Systems

We previously exposed the fundamental schism between knowledge and action in respect to the challenge of global warming, a schism recognized in the Glasgow Climate Pact (2021) COP26 [24], in charge to revise the state of advancement of the goals set in the Paris Agreement.

Who is to blame for the failure? This analysis evaluates global warming from the perspective of the social apparatuses that mediate every satisfaction of our needs, while creating junctures that both unite and separate us from the natural world.

We use the insight from Luhmann's social systems theory [25]. Luhmann discerns two varieties of complexity. There is first, the complexity that results from the natural world. Second, there is the secondary complexity, developing from the multiplicity of social systems and mechanisms that progress to diminish the burdens of natural complexity. In the current analysis, we assess the role that social systems play in the making of climate warming, as systems produce secondary complexity. The general form "social system" allows to comprehend the nation state and the corporation as organizational systems, and as apparatuses that exert agency. We use also the first Latour who extrapolated the semiotic notion of actant [26] to comprehend non-human forms of agency. Likewise, Luhmann examines social systems as emergent forms of communication that are self-referential, and develop autonomous operations and programs in dealing with their distinct topic matter, social systems that occur in separation from humanity. Both Luhmann and Latour substantiate our understanding of a technologically mediated society where humans share the phenomenological ground with non-human forms of agency. This specific feature is central for understanding how actants-systems usher the production of global warming.

Luhmann proposes understanding social systems as emergent forms of communication, that are self-referential, and may develop autonomous operations and programs in dealing with their distinct topic matter. Systems are reflexive, as their operations follow their internal sense-making. Luhmann understands society as the sum of all communications, and the organization as a specific form of communication that builds on decisions. Social systems intermediate between bare humanity and the world. Let's call to mind that bare life [27] takes the foundational meaning of just living, life as it comes, life that is not accounted for by the law or by other system. Bare humanity does not create an environmental hazard. In contrast, social systems alleviate the burden of the natural world while developing further secondary complexity. In fact, the development of global warming is in direct relationship with the industrial society, as it required the development of expert production and energy systems.

Organizations [28] address the necessity to absorb uncertainty. Organizations transform uncertainty into certainty by linking decisions.

Organizations display a mastery in numerous communicative codes:

First, corporations understand and use the code profit to advance their imbrication with the larger economic system.

Second, the corporation acknowledges the importance of regulatory power, that it first integrates as information worth considering, as it can disrupt the normal concatenation of operations. The corporation can develop legal strategies to deal with the financial risk arising from changing regulatory frames. It can also invest in political lobbying to transform the regulatory frame to its advantage. It can shift its form, developing coordinated management, from national to global.

Third, the corporation is a social technology that controls technical codes. Innovation, efficiency, and the use of supervening technologies such as modern communications grant the corporation its ability to

anticipate global trends and keep growing.

Sense-making differs for each kind of system and the particulars of its communication. Firms, corporations, companies 'speak' the language of the economy as a social system. Organizations discriminate between commodity markets, labor, and financial markets. Organizations can also understand how external regulation affect the opportunities for profit. Such flexibility surges from the absence of essential contents for the form organization. Because its identity is realized by interconnected operations, organizations are compatible with all structures that permit the continuity of such concatenated operations.

Profit organizes the recursive interconnection of operations, following the primordial diktat first identified by Marx in the mechanism of profit production. Operative closure warrants the continuity of the activities seeking profit. Nevertheless, the risk of a difficult relationship to the system's environment may force cognitive openness, pushing the system to consider external codes and programs. As an example, oil spills may introduce, within the system, the extraneous notion of a natural environment that needs to be dealt with, to avoid the punitive consequences that come from a legal system with the power to enforce penalties. If the internalization of a foreign code projects future events, it is rephrased as risk. When the internalization of such code happens after a catastrophe, it becomes an issue of damage control, or how to impede further loss of profit. Then, political, social, or natural environment considerations may be considered within the operations of the economic system in question. An oil company may publicize that it has changed its ways, investing in planting trees and the arts, and that it cares for its human capital, or it may effectively invest in green technologies for energy production.

Pressure from other countries or from the system's stakeholders may force the system to consider integrating responsible behavior and mechanisms for self-accountability. Climate risk is construed reflexively, as financial risk: the risk to diminishing investment performance due to climate change and changing regulation.

In sum, reflexivity in systems orchestrates a mutual and reinforcing relationship between investments, know-how, existing technologies aiming profit production. Once the system takes its form, it creates a normalized, self-maintaining pathway for further economic communications. Then, for organizations profiting from fossil fuels, the use of existing technologies, institutions, and behavioral prescriptions hinder their attempts at reducing carbon emissions, in what is known as carbon lock-in: a case of path dependency in complex systems.

In carbon lock-in [29] there is an intense tendency towards stability, explained by immense capital costs, infrastructure lifetimes and non-virtuous feedback with other social-technical systems. This is because the current global structure of energy production still favors fossil fuel technologies, discounting their inevitable collateral damage on the environment.

To date, restrictive supply-side policies [30] are missing from the toolkit of policies against global warming. Energy production is caught on a path dependency on fossil fuels. Organizations caught in such non-virtuous feedback forsake alternative sources for energy production, continuing the way indicated by initial conditions, hooked to the expectation [31] of increased returns to scale [32], while crystallizing habitus in social corporative behavior.

7 Carbon Majors

Having set how reflexivity performs in companies, we can now consider the ontological stance of carbon majors. The Carbon Majors database [33] lists ninety producers engaged in coal, oil and gas, and cement production, accounting for two-thirds of the total historical industrial CO2 and methane emissions worldwide. The nation state has been the historical source for tracking large scale Greenhouse Gas emissions (GHG). Alternatively, the database allows for tracking these emissions to a smaller group of commercial decision makers. Together, nation states and companies are the main actants producing anthropogenic emissions that cause global warming.

The database classifies [34] companies, distinguishing between investor-owned corporations; state-owned entities; and lastly, state producers. The grouping allows to identify the regime for reclaiming accountability.

For instance, investor-owned companies can be public or private, defining different legal regimes. In the case of the state-owned entity in rule of law governed societies, the state may be held responsible for the effects caused by the actant, under the national law, seeking the protection of the human rights of national citizens. The cases of state-owned entity and state producer display dissimilar regimes for accountability, including the total absence of accountability mechanisms. Then, "State producer" identifies 7 coal producing nations, bringing the necessity to understand their status regarding the accountability for their actions.

The database allocates emissions in proportion to the percentage of investment from each ownership classification. An important part of the spectrum is private ownership, including individuals, venture capital, private equity firms, holding companies, insurance companies, and corporations.

The data is organized in respect to boundaries. The company develops operations and perform activities under legal and operational structures. Operational boundaries are used to identify whether the emission scopes are direct or indirect. Categories include direct company emissions, indirect emissions deriving from purchased energy carriers such as electricity, and value-chain emissions. Value-chain comprises 15 distinct categories of which Category 11: 'use of sold products' accounts for over 90% of total fossil fuel company emissions.

The carbon majors respond to their reflexivity, as their activities are ordered following their specific sense-making: Profit production. Profit expectation activates the flow of economic operations, functioning both as a source of subsequent revenue, and as a test on the environment. A venture is worth seeking if it brings prospects of profit. The information coming from the carbon majors describes the minute operations driven by financial gain.

We learn that fossil fuel related emissions account for about 90% of global industrial greenhouse gas emissions, and about 70% of total global anthropogenic emissions. Since 1988, fossil fuel has become more carbon intensive. The contribution of fossil fuels to global warming has doubled since 1988, and coal takes the largest share. Furthermore, newer large ventures have made appearance. Emergent extraction enterprises such as Suncor, ExxonMobil, Chevron, Shell, and ConocoPhillips have funded the extraction of oil sands, tight oil, heavy oils, and other forms which carry a larger environmental impact than conventional oil production.

Another type of actant is the national producer, featuring an array of organizational forms. The state may privatize its assets and then newer, more flexible forms of actant emerge to invest and managethe assets of fossil fuel production. It is the case of China, in coal production, and Russia. In other cases, the state keeps direct control of the assets, as in Saudi Arabia, the United Arab Emirates and Kuwait.

If the exposed path continues, Earth's temperature will rise above 4C, producing existential danger for the whole chain of being. In 2022, the dire situation has worsened by the current war between Russia and Ukraine, and the impending geopolitical shifts already impacting the political economy of energy production and distribution.

From the data we observe that Carbon Majors behave reflexively, acknowledging the complexity of the external world in their own terms, constructing a version of reality that allows their differentiation and economic continuity.

Reflexivity is at odds with the idea of an enlarged consideration of the environment because the parameter of efficiency develops by defining external information as impertinent. The notion of a natural environment that entails a duty to care for it, is extraneous to the system. Ethics, human rights, critically warming weather, are merely external noise that is translated as a meaningful topic only if the noise threatens the continuity of internal operations. Accordingly, the notion of sustainability is not essentially related to the natural environment. For organizations, sustainability means pondering the economy, the law, or other companies as ecological boundaries that need to be accounted for if, the organization is to remain viable in such an environment. Furthermore, companies tend to decipher nature as an externality, while considering the actions of other corporations or stakeholders as their proper environment; and will primarily incorporate environmental damage as reputation risk, only if it diminishes its value. Reflexivity in systems underlie the schism between knowledge, intention, and action, enhancing dependency paths [35]. Reflexivity causes the system's deafness to hear the urgent call for addressing climate change.

8 Assessing the Need for a Change in Paradigm in Governmentality

As a complex, multidimensional object, governmentality [36] takes different meanings depending on the perspective that sets its contents. Power happens within a relational mode of operation [37], while governmentality links the technical regulation of the conduct of men in reaching a common objective with the required modes of thought and behavior expected from the modern subject. Like the two sides of a coin, governmentality takes a dual semantical form. Yet there is a third signification: the activity of guidance, steering. Foucault understood governmentality in a transversal relationship concerning the state which is a historical configuration of the political. Governmentality, as the practice of steering, transcends the form of the national state, and in the current state of scientific knowledge arising from Earth sciences, forces the consideration of the critical ceiling of ecological boundaries.

The impending environmental crisis forces a redefinition of the notion of governance. It first asks for a prioritization of its topic matter, taking stock of the limits imposed by the Earth's sustainability [38]. Since a relatively small number of actants is causing the most damage, steering their behavior justifies narrowing it to the ways of being of the actants. Companies and nations in the list of carbon majors need to be framed as specific forms of subjectivity.

The challenge of governmentality finds resonance in the current, albeit limited and fragmentary, regulatory responses to address the impending climate crisis. Actants encounter two main novel regulatory proposals that complement the existent soft law regime of pledges and national commitments. First, there is the regulatory challenge from the political system to address the consequences of climate change for global financial instability. Here, a novel approach towards reaching efficient accountability seeks to regulate corporate behavior integrating compulsory environmental, social and governance reporting. Second, there is the self-regulating proposal coming from institutional investors pledging to behave responsibly. In companies, institutional investors are developing the Principles for Responsible Investment. Together, the self-regulation of actants and the pressure from above anticipate novel, and more stringent standards to seek actants' accountability.

Governmentality, in the context of climate warming is interwoven with the notion of accountability. We previously exposed the notion of hard and soft law within the UNIL system. As soft law lacks features such as obligation, uniformity, justiciability, sanctions, and/or an enforcement staff, it is the preferred choice for international relations. In international law, soft law mechanisms build on the reputation that countries have, considering their stance before the international community. The efficacy of soft law builds upon the need that countries must maintain their reputation. Shaming countries or corporations appear as a straightforward tool to change policies and countries behaviors. Yet when most of the countries behave shamelessly by developing policies counteracting their carbon emission goals, the efficacy of shaming is nullified. Instead, shaming has created some symbolic behavioral transformations. Governments have bought carbon offsets to nominally decrease their carbon emissions or footprint. Companies have green-washed their practices and brands, without changing their real production of emissions. Soft law mechanisms as self-regulations and self-proclamations have limited practical value, as they express good will and better intentions that lack punitive consequences for unfulfilled commitments.

The absence of hard-law mechanisms hinders the legal adjudication by supra-national courts. The incipient and fragmentary nature of the International Law (IL) system impedes allocating juridical consequences to national states that fail their duty to diminish their emissions. This is the case for China, Russia, India, the Middle East countries, Australia, the USA, and many more.

The way out of the schism seems to signal the path of hard law. More prescriptive than soft law, it defines how and when the objective is to be achieved. Hard law for environmental protection is often present in national regulations, often restricting a fraction of the economic activities while prompting markets to consider a regulatory boundary. Considering the urgency of the environmental impending crisis, governmentality before corporations and national states needs to assert binding power entailing negative outcomes for transgressors.

9 Litigation

Notwithstanding the feebleness of IL, there are residual mechanisms that have been used successfully for enlarging climate governmentality. National courts are creating case-by-case, strong accountability. As an example, the Urgenda Foundation and 900 Dutch citizens sued the Dutch government to do more to impede global climate change [39]. The Hague court found that the government pledge to limit emissions was insufficient to maintain global temperatures within the UN goals. The court thus ordered the state to limit GHG emissions to 25% below 1990 levels by 2020. The court founded its decision upon an assortment of soft and hard law sources and legal principles;

(i) the Dutch Constitution;

(ii) the EU emissions reduction targets;

(iii) the European Convention on Human Rights;

(iv) the IL principle of no harm, and foremost;

(v) the national law doctrine of hazardous negligence, among many others.

The ruling was upheld by the Hague Court of Appeal, that determined that the Dutch government acted unlawfully contravening its duty of care, under articles 2 and 8 of the European Convention on Human Rights, against the threat of global warming, applying provisions with direct effects in treaties in which the Netherlands is party.

Here, national hard law (the Dutch Civil Code) was the legal source granting to determine that the Dutch State breached its obligation to take precautionary measures to mitigate a hazardous situation. Afterwards, sources of soft law were incorporated in the ruling, as the District Court contemplated United Nations and European Union climate agreements, along with international law principles and climate science, to define the scope of the state's duty of care with respect to climate change.

The case highlights the reflexive relationship between soft and hard law, while involving the need for hard law to establish environmental duties. The standards of care were specified using UN resolutions and EU agreements, allowing the Court to conclude that the government acted negligently when it set a target for CO_2 emission reductions at 17 percent compared to 1990 levels, instead of 25 percent. However, it was the hard law of the civil code that enable determination that the Netherlands was knowingly exposing its own citizens to danger, incurring a wrongful act. Soft law was again at stake when the Court found that implementation of adaptation measures alone is insufficient to fulfil the state's duty of care. The Court ruled that mitigation is the "only effective remedy", determining that the Netherlands has a duty of care to mitigate as quickly, and as much as possible. This case constitutes a prime example of a legal coding (legal/illegal) enforcing the duty of care within the activities of a Nation State as an actant. It reaffirms the power of the legal system to steer an actant out of its inertial course of action.

Another important case is Milieudefensie et al. v. Royal Dutch Shell plc [40]. Milieudefensie alleged that Shell's contributions to climate change violated its duty of care, and human rights obligations by failing to act against climate change. The plaintiff argued that Shell had thorough knowledge on the causes of climate change, produced misleading statements on climate change and failed to reduce climate change, endangering Dutch citizens. The Hague District Court ordered Shell to reduce its emissions by 45% by 2030, relative to 2019, across all its operations, including its own emissions from the use of the oil it produces. Furthermore, the Court concluded that the standard of care involves taking responsibility for Scope 3 emissions, specifically when these emissions compose most of the company's emissions, as is the case for companies that produce and sell fossil fuels.

The selected cases are part of a wider trend on demanding accountability via the legal system. Despite the limitations of the UN system, there are indications of the tendency on integrating within its operations, the definition of the illegality of actions that cause climate change. This incorporation is still limited, as the requisites of hard law are still nascent. In this process, the IPCC has advanced that climate litigation is another venue to challenge and cooperate over the governance of climate change.

Historically, governmentality dealt with the problem of shaping human beings into accountable subjects. Seeing the participation of non-human forms of agency in the making of climate crisis, a paradigm change should encompass the behavior and liability of corporations, and national states.

Understanding the self-referential nature of nations and corporations allows observers to see why their behavior is impervious to climate crisis, and to develop the steering mechanisms to frame their activities, through an enlarged notion of governmentality.

Organizations exhibit a proficient use of the codes and programs of technological systems. Money as a medium of communication, within the economy as a social system, and power as a mechanism for producing collective action within politics as a system; are both media of communication endowed with enormous communicative power. Such media allow for transversal exchanges between organizations and society, allowing organizations to integrate the climate exigencies, if regulation compels them [41]. Furthermore, strong regulation from the law as a system grants the possibility to connect the protection of human rights to the actant's behavior. Regulation forces organizations to consider external facts such as health hazards into their operations, reducing the strength of their overarching aim of profit making. Conversely, weak regulation diminishes the chances to steer organizational behavior, and organizations may try to dismantle the regulatory impediment.

The significant problem remains of establishing a causal relationship between actant's behavior, global warming, and emergent damage. This requires a legal frame of distinction [42], identifying causes and effects, enabling to connect actions to damages and penalties.

10 The call for a second-level observer

The schism between knowledge, intention and action continues as the systems resume their self-defined, myopic path. Meanwhile, EWE confront actants with the reality of a natural, disruptive temporality. The World Meteorological Organization informs that the number of disasters has increased by a factor of five over the last fifty years, and has caused US 202 million loses daily. Economic loses, counting from the seventies have increased sevenfold [43].

Considering litigation cases, it becomes clear that growing demands for governmentality request precision and speed in gathering and evaluating information [44]. However, organizational reflexivity hinders constructing an overall picture of the required information at the necessary speed to address global warming. Luhmann's notion of "second level observer" can help circumvent the problem of reflexive systems that fail to gauge the conditions of their environment. In social systems theory, every observation is made within the constraints and possibilities that the phenomenological stance of the observer allows for. Likewise, every perspective carries, simultaneously, a view and a blind spot. The actant has a unique perspective that builds from what its structure allows to be seen as observable. If the perspective is too narrow, the actant may disregard data that is crucial for its own continuity. The corporation, which behavior seeks decision making for profit, can neither see ethical considerations nor understand natural environment data unless such data is construed as relevant for profit. A second party can see what the corporation cannot, but in its turn, such a second party has its own blind spot. A legal system setting the conditions for making the corporations accountable can see and evaluate the blind spot of the corporation. Such legal system, in its turn, can only operate within its own reflexive codes. Reflexivity creates a veil, impeding the direct observation of anything that the system does not consider as its topic-matter. Reflexivity can be pierced when media of communication conveys the information that was discarded, forcing external complexity within the concerned system. An example is found in banking law of some countries, that protects consumers. This law forces financial entities to behave in good faith while offering the best advice to the applicant-consumer, regarding the financial product that best suits the consumer's financial circumstances. Let's now discern in detail what is at stake. On the one hand, there is a financial entity which main purpose is to make profit from its business of dealing with financial and monetary transactions. On the other, there is the client. Between both intermediates the legal framework, which imposes upon both parties the whole complexity of the law, defining that it is illegal to act in a manner that

goes against the regulation. Here, the code legal/illegal confronts the financial entity with the complexity of punitive consequences that it is forced to consider. In each financial operation that considers the legal code, the veil of ignorance of reflexivity has been pierced, allowing for external information to be accounted for, integrating the code legal/illegal within the normalized operations of the financial entity.

In the case of climate governmentality, there is no overarching, general legal framework. Nevertheless, there are some incipient mechanisms as indicated in the section dealing with litigation. There, soft and national hard law signal the budding stabilization of ways forward to claim accountability. At this point of the analysis, the logical necessity is to advance ways to acknowledge the different levels of blindness of carbon majors, as to pierce their reflexivity- induced veil of ignorance. By examining the speed of climate change and the lack of accountability of carbon majors it becomes clear that there must be an additional observer to precisely identify the blind spots caused by reflexive behavior. Artificial Intelligence (AI) could fulfil this need, enhancing the chances for climate governmentality.

We understand hereby, AI as:

"A system's ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation." [45]

This definition is supplemented with the requirement for AI to perform ethically, within the boundaries of human rights protection; and integrating both the notion of biosphere stewardship [46] and the 17 Sustainable development goals (SDGs). AI thus conceived is an idealized version of actual developments.

Ellul's insight on technique sources the call for AI. For Ellul, Technique is "the totality of methods rationally arrived at and having (for a given stage of development) in every field of human activity" [47]. In the same line of thinking, technological problems can only be solved within the confines of technique, for technique sets the horizon of what is possible, indicating the ways forward.

In this setting, AI [48] is the disruptive technical way to the future: general enough to allow for dual uses at all levels of society's production, AI can be tailored to the problems it addresses. AI can be a tool in the fight against global warming in spite of its dependency on electricity that hinge on fossil fuels [49].

- **Ubiquitous observer.** AI is capable of intensive surveillance. While AI can help companies in maximizing efficiency, what matters more for the ends of climate governance is the capacity it brings to provide data, and precisely evaluate anthropogenic factors driving global warming. Monitoring is a normal activity for satellites using sophisticated probes and algorithms to seize and evaluate the transformations that human activity has produced on Earth systems [50]. A case in point is the use of AI in satellites [51], scrutinizing the atmosphere [52], gathering data integrated into a complex scientific system of observation available to global users.

  In confronting the problem of actants behavior, data gathering, and surveillance advance the conditions for exerting accountability. Information is crucial in the chain of activities that integrate the notion of climate governmentality. Surveillance links actants to activities producing anthropogenic emissions. Climate governmentality necessitates gathering reliable data on fossil fuel-related emissions. It then assesses its impacts on Earth and social systems, following the UNFCCC that includes 34 essential Climate Variables [53] involving observations from space [54].

- **Technical amplifier for scientific knowledge and superior calculator.** AI builds upon previous technological revolutions, as big data [55]. Big data involves colossal datasets requiring a scalable architecture for efficient storage, handling, and analysis, featuring Volume, Velocity, Variety both in structured data and unstructured data, Veracity, Variability, Visualization, Value to improve decision making. Building from such qualities, AI can compile and extract information for fighting global warming. As an example, the UN early warning system [56], following the scientific advice of the (WMO) released two major strategic proposals to ensure early warnings [57], for all regions of the planet. Additionally it has also proposed a Greenhouse Gas monitoring system as part of the support for the United Nations IPCC Intergovernmental panel on Climate change (IPCC).

- **Universal mediator.**Considering that systems are operationally closed while remaining cognitively open, AI can highlight obscured notions that systems need to integrate in their sense-making

production. This task can be developed by an AI observing the blind spots of organizations and systems, identifying which notions would allow for transitioning from a carbon locked-in [58] status towards a carbon free productivity model.

Reflexivity in systems yields distinct outcomes. For instance, the oil and gas industry recognize the environmental call to stop emissions as there is a changing regulation. Concurrently, the industry perceives the stress in energy production caused by the invasion of Ukraine, and deciphers the event as an opportunity to squeeze the juice of previous investments and augment profit, while increasing its participation in the market share. Likewise, for the nation state, it is the time to secure fossil fuels without considering the vendor's ideology or respect for human rights standards.

In contrast, for victims of rising sea levels, the time to stop emissions is immediate. Between the distinct reasonings and temporalities appears the need for a translator, a universal mediator enabling the industry to see minute opportunities for profit in newer technologies while attending the facts of global warming from the scientific perspective.

AI can disclose the functioning of the organizational black box of carbon majors as to render its internal processes open and transparent [59] to environmental and ethical critique, increasing the spectrum for regulation.

- **Time accelerator.** AI, supported by supercomputers, accelerates calculations, and optimizes informed decision making. While duration is objective, organizations consider timeframes and construe their distinct temporality. For a system, time it is about how long it takes to perform the system's operations. While the extent remains the same, both its perception and the cumulative effects of calculation are intensified. This can be used for accelerating the pace of reduction of CO_2 and other anthropogenic gases. Several paths are considered. First, AI can use actual big data and calculating capacities numbers to compare Carbon Majors emissions; with their pledges and the Sustainability Development Goals SDGs, over three dimensions:

  1. Big data dimension [60]: Encompasses corporative and national production of global warming emissions in their relationship with discernible patterns [61] arising from big data, gathering self-disclosure mechanisms and their drivers.
  2. Measuring actual anthropogenic emissions. Contrasting existing data from self-disclosure mechanisms to data arising from novel surveillance tools such as the satellite viewing of global warming emissions.
  3. Dodging path dependencies. AI can use statistical models inscribed in deep learning for anticipating the probability of future events. Banks are important stakeholders financing fossil fuel companies [62]. The Basel agreements [63] seek the stability of the global financial systems. For banks, the prospect of market risk losses is calculated using ES, a mathematical formula that implies a time horizon in relationships with a level of confidence in which the capital is defined by the shortfall. This supplements the coverage to the average loss once the threshold is exceeded [64].

     AI can identify ES [65] and convey the risk of carbon majors' investments for banks. Banks can suffer market losses associated with global warming. AI can also integrate the liquidity risk that results from a changing regulatory environment for the companies. AI can produce models of future states of companies [66].

     Furthermore, AI can produce model of future states of companies in and outside of the carbon path dependency. AI can teach companies how to replace fuels, while market simulation tools such as CarbonSim EDF's can help investors to reduce pollution at the least cost [67].

- **Restorer of broken causality [68].** In the context of a global society defined by social differentiation, there is a separation between scientific knowledge of facts and how such knowledge is integrated as part of the topic matter of the legal and political systems [69]. Allocating legal responsibility for

wrongdoing requires a clear regulatory framework and a strong causality link between actions and deleterious consequences, helping to establish the liability for wrongdoing. AI can help in restoring the link between distinct carbon emissions and EWE, using techniques such as probabilistic climate event attribution studies [70], and similar statistic AI enhanced calculations, facilitating litigation. [71].

11 Conclusions and Discussion

This analysis offers a scaffold to understand and explore ways to enhance the governmentality of climate. The sections provide an entry point to further develop specialized studies that can effect transformative action. Some of the findings are:

- Insufficiency of current UNIL structures
- Uncoordinated communications between science, the political and the law as social systems.
- Necessity to comprehend the cognitive mechanisms of organizations that cause them to disdain existential risks.
- The governmentality of climate change demands to tackle actants.
- In the absence of an overarching supra national law system, national jurisdictions that include environmental protections advance the process of enlarging governmentality.
- Rulings necessitate restoring the causal link between emissions, extreme weather events and liability.
- Artificial intelligence offers promising paths, if contained within ethical and human rights protections.

To date, the UNIL system is incipient, displaying mixed signals from a variety of partial systems while lacking the self-reference that would allow it to rule over its parties. Scientific truth has been integrated in the IPCC but contends with the communications from the economy, that have so far prevailed in the decision-making of parties. Carbon majors cause the majority of anthropogenic emissions remaining in carbon lock-in.

Legal causation needs strong fact checking for EWE to be linked to the actions of the direct emitters of anthropogenic warming gases. EAI is well placed to helping restoring causation between emitters and EWE.

In respect to the core notion of reflexive behavior, AI has superior surveillance capacities which place it in the position of being a second order observer of the comportment of carbon majors. Furthermore, its translational abilities can enhance the capacity of media of communication to pierce the reflexivity of carbon majors.

Awaiting the birthing of an autonomous legal international system, AI can help overcome the schism between knowledge, intentions, and actions. If disciplined by hard law, AI can integrate both the protection of human rights, the notion of stewardship and the UN sustainability goals. This is to balance the part of each as to orient a virtuous ethical AI.

Discussion

The crucial problem remains relating to the form and boundaries of AI. AI is a complex, and even more convoluted form of derived complexity that has blossomed under the umbrella of corporations and powerful national states. AI displays the attributes of alienation of other complex technologies, developing on its own a path far from the needs and values of humanity. How can we steer its behavior?

Two major dangers emerge at first sight. First, the dangerousness of a technology integrating efficiency and economic coding within organizations, worsening the already wicked problem of path dependency. Second, remains the threat of excluding the notion of accountability before human rights, and the welfare of populations.

Conclusion

At the end, understanding actants as liable doers amplifies both the notion and the practice of governmentality. Furthermore, there is a direct gain for the level of humanity: we can reclaim spaces for exerting human freedom. We can remember how profound is our need for nature. We can then see ourselves and our communities intensely intertwined with all beings. Ultimately, we can recognize the planet as a whole vessel for life perseverance.

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