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# Big Data, Algorithms, AI, Ethics, and the Economy: An Aristotelian Perspective

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## 1. Introduction

While a growing body of literature points to the advantages of using algorithms in big data processing, as well as applying them to artificial intelligence (AI), in order to achieve a desired output, it also warns about the pitfalls and perils in algorithm decision-making. Algorithms and AI are the machines and big data is the new oil. Criticisms come from different fields: legal, social, political, medical, and the economic. They argue that algorithms have the power to predict our wishes and behavior and, subsequently, to manage our life: they decide the music we listen to, the news we read, the information we obtain, the content we see online, the movies we watch, the health care we receive, the products we buy, and so on.

These achievements certainly represent an advancement in techniques that we must be willing to embrace. However, they confront us with the well-known technological ambivalence, that is, the fact that technology can be used for good or for bad. In this case, though, advances are global and radical. We are facing a new way of living with a profound anthropological impact, a new social order, the “algorithmic society”, which Balkin has described as, “a society organized around social and economic decision-making by algorithms, robots, and AI agents” (2018: 1151, nt. 1). Balkin asserts, “The Algorithmic Society features the collection of vast amounts of data about individuals and facilitates new forms of surveillance, control, discrimination and manipulation, both by governments and by private companies. Call this the problem of Big Data” (2018: 1153).

The vast literature on the power of algorithms, big data and AI in decision-making has studied the balance between positive and negative future effects and have found a tendency to the latter, thus encouraging the need to seek ways to apply these techniques to social good.

Shoshana Zuboff (2015 and 2019) coined the expression “surveillance capitalism” to describe how big corporations are using algorithms and big data to predict users’ behaviors and offer products, often modifying human behavior as a means to produce revenue. Thus, we face perfectionism in instrumental rationality, which, albeit neutral in itself, in the hands of corporations renders a positive service, but conditioning if not manipulating our decisions.

According to Zuboff, surveillance capitalism originates a new economic order that claims human experience as free raw material for practices of information extraction, prediction and sales. Knowledge and freedom are controlled by big tech companies, thus leading to asymmetries of knowledge and asymmetries of power.

The literature also dwells on the likely impacts of artificial intelligence on employment and its social implications, even within people working in the industry: the rise of a “coding-elite” of software developers, investors, professors, etc., and of a “cybertariat”, those who do the menial work, as described by Jenna Burrell and Marion Fourcade (2021). For them, algorithms are ethico-political entities.

What should we do? In her book *Technology and the Virtues*, Shannon Vallor answers: “we need to cultivate in ourselves, collectively, a special kind of moral character, one

that expresses what I will call the technomoral virtues” (2016: 1). She explains: “21st century decisions about how to live well—that is, about ethics—are not simply moral choices. They are technomoral choices, for they depend on the evolving affordances of the technological systems that we rely upon to support and mediate our lives in ways and to degrees never before witnessed” (2016: 2). She builds on the Aristotelian, the Confucian, and Buddhist conceptions of virtue.

In this paper, after a short section on the nature of algorithms and AI, I will summarize in Section 3 the pros and cons of the algorithmic society. Then, I will dedicate a short section to the impact on the economic realm. Further, I will point out possible solutions to the problems raised by the spreading of algorithms and AI. Finally, before concluding, I will show that, solutions aside, given that this issue will require developing virtues (Section 6) and a new vision of the economy (Section 7), their corresponding Aristotelian notions may prove a useful source of inspiration.

## 2. The Nature of Algorithms

Algorithms, big data, and artificial intelligence (AI) are three related concepts. According to Tarleton Gillespie (2014: 167), “in the broadest sense, [algorithms] are encoded procedures for transforming input data into a desired output, based upon specified calculations. The procedures name both a problem and the steps by which it should be solved.” Computers use these algorithmic procedures. “Big data” refers to massive data sets that are generated from a wide variety of sources (social networks, mobile phones, cameras, etc.) with the purpose of identifying problems and opportunities, deriving best practices, capturing synthetic information, etc. Big data has specific characteristics: volume, velocity of data processing and variety of types of data. Other characteristics of big data are data value and data veracity.

Artificial intelligence (AI) is the simulation of human intelligence processes by computer systems. It consists of a group of algorithms that can modify its algorithms and create new algorithms when given new data and inputs. AI can process data provided by Big Data to detect patterns that provide useful information.

As stated in the introduction, algorithms and AI are the machines and big data is the new oil. However, they are not conventional machines, but virtual machines. According to Davide Panagia, (2021: 2 and 7) they are “automated systems for the perpetual arrangement and rearrangement of relations” and this means that “they barter in probabilities and correlations and not verifiable or derivable truths”. They are not representational media. “The algorithm’s dispositional power is a power of perpetual arrangement and rearrangement of *capta* that measure weights and values which in turn generate world relations that are neither indexical nor analogue, but virtual” (2021: 9-10). Virtuality and negative feedback are the algorithm dispositif’s modes of existence. Negative feedback is required to match the behaviour of the AI with its goal.

Louise Amoore (2020: 13) considers “the algorithm not as a finite series of programmable steps but as perennially adjustable and modifiable in relation to a target output”. She “understand[s] the spatial logic of algorithms to be an arrangement of propositions that significantly generates what matters in the world” (2020: 12). The

arrangement of propositions, according to Amoore, is transformative and performative (2020: 13). She adds (2020: 14):

As Isabelle Stengers has noted of the proposition, “It is crucial to emphasize that the proposition in itself cannot be said to be true or false” because in itself “it is indeterminate with regard to the way it will be entertained.” As a proposition, the algorithm can similarly not be said to be true or false—it cannot be held to account for its relation to truth in this sense. A pattern of false positives from a biometric algorithm, for example, can never be simply false because the threshold is immanently adjustable.

She also provides the example of the output of a facial recognition algorithm and states that is never true or false but “a useful proposition that can be infinitely recombined” (2020: 14). Rob Kitchin asserts that algorithms are ontogenetic in nature, “always in a state of becoming” (2017: 18), somewhat uncertain, relational, contingent, performative, not neutral.

Tobias Rees (2022) contends that “Large Language Models” like the recently introduced GPT-3 (Generative Pre-trained Transformer 3) give rise to a new concept of language, disrupting the idea that only humans have language or words. I will not explore here this questionable theory, although it certainly reflects the ground-breaking character of these technological advances. Human language lies in knowing or thinking and no AI can think; it takes words and converts them into numbers, processes them and translate the numerical results into language: this is not an explanation of reality. Henry Kissinger (2018) warns:

Ultimately, the term *artificial intelligence* may be a misnomer. To be sure, these machines can solve complex, seemingly abstract problems that had previously yielded only to human cognition. But what they do uniquely is not thinking as heretofore conceived and experienced. Rather, it is unprecedented memorization and computation. Because of its inherent superiority in these fields, AI is likely to win any game assigned to it. But for our purposes as humans, the games are not only about winning; they are about thinking. By treating a mathematical process as if it were a thought process, and either trying to mimic that process ourselves or merely accepting the results, we are in danger of losing the capacity that has been the essence of human cognition.

In sum, given AI and algorithms’ virtual and dynamic self-correcting characteristics, we are facing a technology that is ontologically different from previous technologies. This condition demands a new ethical reflexion that will be introduced in Section 6.

### 3. Pros and cons of the algorithmic society

The literature on this topic has developed an extensive list of pros and con of the algorithmic society. I would like to mention a few.

#### 3.1. Pros

Combining AI and big data brings obvious benefits to our everyday lives. As Peter Bentley states, “artificial intelligence has amazing potential to improve our lives, helping us live healthier, happier and generating large numbers of new jobs.” (EPRS 2018: 11).

Miles Brundage (EPRS 2018: 13) affirms: “if humanity successfully navigates the technical, ethical and political challenges of developing and diffusing powerful AI technologies, AI may have an enormous and potentially very positive impact on humanity’s wellbeing.” Upsides of AI may include task expedition, improved coordination and leisure society.

“Code-Dependent: Pros and Cons of the Algorithm Age”, a report by the Pew Research Center (2017), enumerates the following pros of algorithms:

- + Better understanding of how to make rational decisions.
- + Connectivity.
- + The need to assess the benefits and deficits or risks the algorithms create.
- + Help make sense and take advantage of massive amounts of data. This may prove useful for banks, health care providers, governments, etc.
- + Faster access to information.
- + Improved police work.
- + Easier transportation.
- + Algorithmic systems perform better than bureaucratic systems.
- + More international commercial exchanges.
- + Better-targeted delivery of news, services, and advertising.
- + Improved stock management.
- + Energy efficiency.

Clearly, the pros are numerous and important. Let us move on to the cons.

### 3.2. Cons:

Let us first mention some “old” thinkers who foresaw the development and consequences of algorithms and AI antecedents. Belgian philosopher Jean Ladrière (1958)<sup>1</sup>, referring to cybernetic machines, stated that they would bring about a bigger transformation than the Industrial Revolution and the emergence of atomic energy and would deeply change the relationship between humans and machines. He highlighted some potential problems: power and investment concentration, social tension, impact on the labor force, and “mathematisation” of the world.

In 1960, Norbert Wiener, known as the founder of cybernetics, warns (1960: 1355):

It is my thesis that machines can and do transcend some of the limitations of their designers, and that in doing so they may be both effective and dangerous [...] This means that though machines are theoretically subject to human criticism, such criticism may be ineffective until long after it is relevant. To be effective in warding

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<sup>1</sup> In 1952, Jean Ladrière published two texts, “Les machines à penser” and “Faits et theories”. In 1956, a unified version of both articles appeared under the title “La cybernetique”, in *Rotary Internacional*. This unified version has been translated into Spanish and published as *La filosofía de la cibernética* (1958), by Ediciones del Atlántico, Buenos Aires, Argentina.

off disastrous consequences, our understanding of our man-made machines should in general develop *pari passu* with the performance of the machine. By the very slowness of our human actions, our effective control of our machines may be nullified. By the time we are able to react to information conveyed by our senses and stop the car we are driving, it may already have run head on into a wall.

Jacques Ellul, a prominent French philosopher, ponders the nature of technique. He exposes the replacement of quality with quantity ([1954] 1990: 58). In addition, he identifies automatism, self-augmentation, unity, universalism, and autonomy as essential characteristics of the modern technique. In his view, the man-machine relationship has undergone such a deep change that it may lead to future anthropological impoverishing.

Reflecting on digital technology implies reflecting on almost every aspect of our daily life. Faced with invisible, automated processes, human beings become subject to the logic of an impersonal power. It is an inadvertent power, insofar as it has the approval of the voluntary actions of those who submit to its power when using algorithms. Rooted in quasi-mechanical criteria, increased algorithmic decision-making threatens to dehumanize us and to curtail our reflexive capacity and freedom. It promotes an increasing individualist culture where people behave according to self-interest and personal preferences.

The Pew Research Center's report (2017) highlights the following cons:

- + Humanity and human judgment are lost when data and predictive modeling become paramount.
- + Algorithms value profitability and efficiency over correctness or fairness.
- + Algorithms shape human decisions without them even knowing it, giving those who have control of the algorithms an unfair position of power.
- + Risk of manipulation by those having access to the information.
- + Increased inequality between educated and uneducated, rich and poor.
- + Biases in algorithmically-organized systems.
- + Algorithms reflect the biases of programmers and databases.
- + Algorithmic categorizations deepen divides.
- + Algorithms make discrimination more efficient and sanitized.
- + Algorithms are value-laden.

Ekbja et al. (2015) point to some attributes of big data that require attention: autonomy, opacity, generativity, disparity, and futurity. They also note that biases may be introduced in the data generation process as well as through data "cleaning" procedures. In tune with Jenna Burrell and Marion Fourcade (2021), Ekbja et al. mention inequalities within the industry (2015: 21). They argue that data value is generated by unpaid consumers (2015: 20) and that big data exerts social control through monitoring, mining and manipulation (2015: 21).

In the discussion section, Ekbia et al address the attributes of Big Data, that is, volume, variety, velocity, value and veracity, as well as its opacity (big data is dark data). They discuss the dual character of big data: empowering, liberating and transparent yet also intrusive, constraining, opaque, and finally conclude: (2015: 22):

The right approach, in response to this unbridled enthusiasm, is not to deny the light side of Big Data, but rather to devise techniques that bring human judgment and technological prowess to bear in a meaningfully balanced manner.

Rob Kitchin states (2017: 17-18) that “Far from being objective, impartial, reliable and legitimate, critical scholars argue that algorithms possess none of these qualities except as carefully crafted fictions [...] Moreover, algorithms are created for purposes that are often far from neutral: to create value and capital; to nudge behaviour and structure preferences in a certain way; and to identify, sort and classify people.” He also comments on the difficulty to have more clarity about algorithms because they are “largely black boxed and beyond query or question” (2017: 15).

Another concern is that AI developments are in private hands. As Metzinger states, “most of the cutting-edge research in AI has already moved out of publicly funded universities and research institutions. It is in the hands of private corporations, and therefore systematically non-transparent” (EPRS, 2018: 30). Balkin (2018: 1207) also raises a point:

The promise, and the danger, of the evolution of new school speech regulation is a world in which large, global, privately-owned platforms become the regulatory agents of nation states. The more these businesses regulate, the more indispensable and powerful they become to the nation states that purport to regulate them.

By “new school speech regulation”, Balkin refers to regulations aimed at the digital infrastructure (2018: 1173ff.).

Yet another concern is algorithmic impact assessments and accountability (see Metcalf et al. 2021). The Algorithmic Accountability Bill of 2017 attributes accountability to the source code, but Amoores (2020) points out that since machine learning algorithms are always self-generating, the code source is never a complete whole.

The impact of AI on the labor market merits special consideration. The discussion surrounding the effects of AI has placed particular emphasis on its impact on the labour market. Some studies have underlined the following predictions:

- (i) Frey and Osborne (2017, 2013) conclude that 47% of US jobs are at risk of automation;
- (ii) According to a 2017 report by McKinsey Global Institute, 51% of U.S. jobs will be automated by 2030; autonomous cars will account for up to 15% of global vehicle sales by 2030; cities will become intelligent; and our future everyday lives will be transformed by the growing potential of “The Internet of Things”;
- (iii) Bughin et al. (2017) predict that proven IA technologies have the potential to replace up to half of all work activities carried out by humans and show that 60% of all occupations consist of approximately 30% automatable activities;
- (iv) Nedelkoska and Quintini (2018) conclude that in 32 countries around the world, people working in the manufacturing industry or the agricultural sector are at high risk



of being replaced due to automation and that women, workers with less education and those who work under a learning contract are more likely to have their jobs computerized;

(v) Finally, a study by PricewaterhouseCoopers (2018) concludes that administrative or office workers face the greatest potential impact in the short and medium term, with potential automation of their work reaching 49% by the end of the 2020s (Hawksworth et al., 2018).

For Georgios Petropoulos (2018) the impact of artificial intelligence on employment, remains unclear. He concludes (2018: 130):

we should not rush into a response (see Atkinson this volume). The time for policy will come, but at the moment we are still in the early stages of understanding the potential of AI and the various ways it might impact our economy. To deepen this understanding, we should promote further social dialogue among all the involved parties (researchers, policymakers, industry representatives and trade unions, politicians and so on). This is a vital first step to better grasp the challenges and opportunities of this new industrial revolution. And although we should not rush to conclusions, we should not adopt a passive attitude. We must act swiftly to assess and understand the implications of AI. The speed with which technology advances may introduce disruptive forces in the market earlier than some people expect.

Thomas Metzinger (EPRS 2018: 29) and Olle Häggström (EPRS 2018: 20) discuss the risks posed by AI, that is, unemployment, economic inequality and social unrest.

Sections 5 and 6 provide solutions to address AI's anticipated negative impacts.

#### 4. Economic impacts of AI

Let's return again to the "old thinkers" mentioned in 3.2. Jean Ladrière believed that the size of investments needed to develop the new techniques would require a state capitalism (1958: 44-45). This is incorrect. Most developments are in private hands. He also foresaw negative employment consequences and the emergence of tensions between workers with educational differences.

Jacques Ellul (1990: 137ff.) argued that technique is the engine of economic development. He also held that technique development would lead to capital concentration and movement of workers between sectors and their subsequent tensions. Economics will become increasingly technical and will outweigh other social sciences, and men will become increasingly "economic".

As mentioned in the Introduction, Shoshana Zuboff coined the expression "Surveillance Capitalism" to refer to a new form of capitalism related to algorithms and AI developments. A difference between surveillance capitalism and capitalism is that the former operates in a more predictable market in which users are not customers but the source of free raw material for a digital age production.

Zuboff (2019: Chapter 18) stresses the following differences between surveillance and market capitalism:

1. Unfettered freedom and knowledge.
2. Absence of reciprocities. People are not consumers but sources of information. Reduced employment.
3. A collectivist societal vision sustained by radical indifference.

Her call is to say “No More”.

Ekbia et al pose the following question: “What reward and reimbursement mechanisms should be implemented for an equitable distribution of wealth created through user-generated content? Even more fundamentally, what alternative socio-economic arrangements are conceivable to reverse the current trend toward a heavily polarized economy?” (2015: 25).

Section 7 introduces the economic ideas of Aristotle as way of inspiration for the new economic thinking that the above-mentioned risks are calling for. Let us take a look at possible solutions.

## 5. Solutions

Several authors remark upon the changes and new legal instruments brought about by Big Data and suggest the need for changes to dominant legal frameworks and practices (Ekbia, 2015: 19), as well as new accountability processes. Ekbia also states: “the complexity and ubiquity of Big Data requires a concerted effort between academics and policymakers, in rich conversation with the public” (2015: 26).

The EPRS has elaborated several proposals which address how to effectively manage AI so as to maximize benefits and avoid risks. Peter Bentley states: “we should be focussing on new safety regulation and certification for each specific safety-critical application of AI.” (2018: 10).

Miles Brundage (2018: 14) asserts that we will have to learn to ensure that AI systems achieve the goals we users intend without causing harm during the learning process, misinterpreting what is desired of them, or resisting human control.

Thomas Metzinger holds that political institutions must produce and implement a minimal, but sufficient set of ethical and legal constraints for the beneficial use and future development of AI. They must also create a rational, evidence-based process of critical discussion aimed at continuously updating, improving and revising this first set of normative constraints (2018: 27). He also maintains that we need a global AI Charter (2018: 28) and a code of ethical conduct (“Any AI Global Charter, or its European precursor, should always be complemented by a concrete Code of Ethical Conduct guiding researchers in their practical day-to-day work”, 2018: 31) and he remarks the problem of unknown unknowns (2018: 29).

The Pew Research Center (2017) proposes:

A legal framework.

Algorithms must be transparent, comprehensible, predictable, and controllable.  
Possibility of interaction.

Governance and accountability structures in place.

Ethical codes.

Basic education, beginning at primary school.

Promoting consumer activism.

Concerning accountability Helen Nissenbaum (2016) highlights the following limitations<sup>2</sup>:

- The problem of many hands.
- Bugs (virus): “software errors including modelling design and coding errors”, (2016: 32).
- “It’s the computer’s fault”: the computer as scapegoat.
- Software ownership without liability: “as is” software.

While traditional ethics assigns responsibility to an individual human being when harm occurs, this is virtually impossible in the case of machine learning techniques, which are based on previous human-algorithm interactions, consistently updated by a number of engineers, and incorporate other algorithms that have their own creators and data sets behind them. Given all these interactions, no individual human being can be held accountable for effects of actions driven by algorithms. Amooore (2020) dwells on this particular topic.

Jack Balkin (2018: 1210) highlights the responsibility of AI creators: “Digital infrastructure owners are not precisely in the same situation as twentieth century mass media enterprises. But like them, they must take up a new set of social obligations to preserve the global public good of a free Internet and a healthy and vibrant global public sphere.”

## 6. Improved solutions

This section will argue, based on Wiener, Louise Amooore and Shannon Vallor, that the proposed solutions are lacking and that there needs to be an ethical disposition in algorithms, AI and machine learning processes.

Terrell Bynum (2004) refers to Norbert Wiener’s proposals for coping with the challenges of new techniques:

Wiener discusses what would count as a good human life. To have a good life, human beings must live in a society where “the great human values which man possesses” (1954, 52) are nurtured; and this can only be achieved, he said, in a society that upholds the “great principles of justice” (1954, 106). In Chapter VI of *The Human Use of Human Beings* he stated those principles, although he did not give them names.<sup>3</sup> For the sake of clarity and ease of remembering them, let us attach names to Wiener’s own definitions:

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<sup>2</sup> See also Cooper, Laufer, Moss, Nissenbaum (2022).

<sup>3</sup> Wiener specifically states that the best words to express the requirements for the existence of justice are those of the French Revolution: “Liberté, Egalité, Fraternité” (1954: 105).

The Principle of Freedom: Justice requires “the liberty of each human being to develop in his freedom the full measure of the human possibilities embodied in him.” (1954, 105)

The Principle of Equality: Justice requires “the equality by which what is just for A and B remains just when the positions of A and B are interchanged.” (1954, 106)

The Principle of Benevolence: Justice requires “a good will between man and man that knows no limits short of those of humanity itself.” (1954, 106)

Wiener considered humans to be fundamentally social beings who can reach their full potential only by active participation in a community of similar beings. Society, therefore, is essential to a good human life. But society can be oppressive and despotic in ways that limit or even stifle individual freedom; so Wiener added a fourth principle of justice, which we can appropriately call “The Principle of Minimum Infringement of Freedom”: (Wiener himself did not give it a name.)

The Principle of Minimum Infringement of Freedom: “What compulsion the very existence of the community and the state may demand must be exercised in such a way as to produce no unnecessary infringement of freedom.” (1954, 106) According to Wiener, all human beings share the same purpose of life, that is, to realize one’s full human potential by engaging in a variety of chosen actions (1954: 52). It is not surprising, therefore, that the Principle of Freedom would be at the top of his list and that the Principle of Minimum Infringement of Freedom would limit the power of the state to thwart freedom. Because the general purpose of each human life, according to Wiener, is the same, his Principle of Equality follows logically; while the Principle of Benevolence follows from his belief that human freedom flourishes best when everyone sympathetically looks out for the wellbeing of all (2004: 66-67).

With respect to Wiener’s thought (2004: 68), Bynum goes on to assert:

all those in society who must cope ethically with the introduction of ICT – whether they are public policy makers, ICT professionals, business people, workers, teachers, parents, or others – can and should engage in Information Ethics by helping to integrate ICT into society in ways that are socially and ethically good. Information Ethics, understood in this very broad way, is too vast and too important to be left only to academics or to ICT professionals. This was clear to Wiener, who especially challenged government officials, business leaders, and public policy makers to wake up and begin to address the ‘good and evil’ implications of the coming information society.

In a later work, Wiener himself points to “a sin which consists of using the magic of modern automatization to further personal profit” (1966: 52), a sin committed by the “gadget worshiper”, “with its slogans of free enterprise and the profit-motive economy” (1966: 53).

In their Code of Ethical Conduct, Madary and Metzinger (2016: 12) offer recommendations for good scientific practice in virtual reality: “Scientists must understand that following a code of ethics is not the same as being ethical. A domain-specific ethics code, however consistent, developed and fine-grained future versions of it may be, can never function as a substitute for ethical reasoning itself.” (2016: 31)

Ethics codes are not enough. Amoore, quoting Michel Foucault and Gilles Deleuze, distinguishes between ethical codes and ethical practice (2020: 7; see also endnote 16, page 174). She states (2020: 165):

In this book I differentiate the search for an encoded ethical framework for algorithms from an ethicopolitics that is already present within the algorithm's arrangements. In so doing, I draw a distinction between a moral code of prohibition and permission (what algorithms may or may not do) and an ethics of the orientation one has to oneself and to others (how algorithms are generating relations of self to self, and self to others) [...]. Our ethicopolitical relations do not follow strictly from some already formulated moral code, for we never have the security of these grounds from which to act.

With reference to Isabelle Stengers, she explains that speculative ambition is ethical in the sense of ethos or habit (2020: 165) and, quoting Simon Critchley, she underscores the relational character of ethics (2020: 171).

Amoore takes algorithmic bias for granted and conceives "cloud ethics" as an ethics taking place within algorithms. She questions the claims of transparency because the ethics that she encourages begins with the opacity of algorithms. She states: "What I call a cloud ethics is concerned with the political formation of relations to oneself and to others that is taking place, increasingly, in and through algorithms" (2020: 7) and, "Just as Spinoza's ethics are ever in formation, forged through ethos, encounters, arrangements, and combinations, so a cloud ethics is located in the encounters, arrangements, and combinations through which the algorithm is generated" (2020: 165).

In her book, Amoore mainly takes up questions surrounding machine learning. In its last Chapter (6) she is concerned with the way in which "cloud ethics could be brought into being in a world that is increasingly shaped through the arrangements of the machine learning algorithm" (2020: 157). She states (2020: 162):

A cloud ethics alters the relation to a future that says "here is a good enough solution" by revaluing the aperture as a moment of decision in the dark, a calculation of the incalculable. The strategy involves reopening the multiplicity of the algorithm, digging under the stories, and attending to the branching pathways that continue to run beneath the surface.

In Amoore's view, algorithms give partial accounts: "Amid the widespread moral panic surrounding the black box of the algorithm and the political demands for transparency, accountability, and explainability, in this book I make a counter case for opacity and the giving of partial accounts" (2020: 164).

Amoore's book has had a big impact. At its presentation in a forum, she insisted: "It is my case in the book that although algorithms cannot be accountable in the sense of a clear-sighted account (e.g., an "opening" of the black box, or "explainable" algorithms), they can be called to give partial accounts of their conditions of emergence (p. 9)" (2021: 46).

Accordingly, it could be said that the individuals participating in the different steps of the algorithmic process should be attentive to the ethic dimensions involved in them. This supposes, as mentioned above, the incarnation of an ethos or habit.

Shannon Vallor's (2016) proposal to develop "technomoral virtues" does not differ much from Amore's stance. For Vallor, the current impact of technology is something completely new, causing a deep transformation in the way people live and in the entire relationship between human beings and technology. In addition, the high pace of change hinders technology institutionalization. Furthermore, AI processes are not transparent but opaque. Kantian inspired codes or precepts are made outdated and a Utilitarian ethics is unable to estimate the consequences of a continuously evolving process. Vallor argues that we need to cultivate personal virtues. She states (2016: 10):

The technomoral virtues, cultivated through the practices and habits of moral self-cultivation that we can learn from the classical virtue traditions examined in this book, are humanity's best chance to cope and even thrive in the midst of the great uncertainties and vicissitudes of technosocial life that lie ahead. This hope will only be realized, however, if these virtues are more consciously cultivated in our families, schools, and communities, supported and actively encouraged by our local and global institutions, and exercised not only individually but together, in acts of collective human wisdom. This is a tall order; but not beyond our capabilities.

Vallor tries to find common roots amongst the Aristotelian, Confucian and Buddhist ethics tradition in order to obtain a global technomoral virtue ethics. She presents the following commonalities (2016: 44):

1. A conception of the 'highest human good' or flourishing that is the aim of ethics.
2. A conception of moral virtues as cultivated states of character.
3. An account of how virtues can be cultivated.
4. A conception of what human beings are generally like.

She focuses on seven elements at the core of practices of moral self-cultivation (2016: 64):

1. Moral Habituation as a gradual transition.
2. Relational Understanding: recognizing that human beings are relational beings.
3. Reflective Self-Examination: Socratic teaching aimed at taking responsibility for own actions.
4. Intentional Self-Direction of Moral Development as a personal aspiration.
5. Moral Attention as sensitivity to the moral dimension of situations.
6. Prudential Judgment: the cultivated ability to deliberate and choose well in particular situations.
7. Appropriate Extension of Moral Concern "to the right beings, at the right time, to the right degree, and in the right manner" (2016: 117).

Finally, she presents, argues and develops a list of technomoral virtues in order to confront increasingly rapid, global, unpredictable technological changes (2016: 120):

1. Honesty, defined as an exemplary respect for truth.
2. Self-Control: becoming masters of ourselves to do good.

3. Humility as a recognition of our limits.
4. Justice as a concern for others.
5. Courage as moral priority.
6. Empathy as feeling for others.
7. Care as an attentive and emotional disposition towards others' needs.
8. Civility as a disposition to "make common cause" with others.
9. Flexibility as a skilful adaptation to change.
10. Perspective: to discern moral phenomena as parts of a moral whole.
11. Magnanimity as a generous disposition towards rightful aims.
12. Technomoral wisdom as an integration of the previously mentioned technomoral virtues.

In the third part of her book, Vallor discusses challenging contemporary technologies, such as algorithmic process, social media, surveillance technology, robotics, and human enhancement technology and relates them to relevant technomoral virtues.

My conclusion is that virtue is indispensable and it is fostered by:

1. Education: formal and informal. They must be taught since youth, promoting a critical attitude and activism. We must bear in mind that algorithms are created by human beings who translate their imperfections into algorithms.
2. Law: a legal framework, ad hoc institutions, "algorithmic accountability" (Pew Research Center 2017: 17, 19).

In the last section of this paper, I will introduce Aristotle's ethical conception of economic activity and its corresponding virtues.

## 7. Aristotle on the economy and economic virtues

In the same way as Vallor takes inspiration from traditional virtue ethics, in particular, the philosophical work of Aristotle, Confucius and Buddha, I propose rethinking economics according to Aristotle's ideas about the economic realm, in search of virtues that will facilitate morally correct economic actions. These virtues would curb the undesired consequences of the algorithmic society in the economic realm.

Aristotle conceived Economics as an ethical discipline, a part of the Aristotelian practical science (*episteme praktiké*). More precisely, Aristotle uses the term *oikonomiké* (here translated as 'the economic').

Although he was not an economist, he stated seminal concepts of 'the economic' and Economics. The economy of his time did not have the characteristics of today, and Economics as such had not yet been established; besides, he only devoted a few pages to these issues. However, those pages contain some ideas that may help to clarify basic notions of the philosophy of 'the economic' and Economics. In the primitive sense used by Aristotle, *oikonomiké* is household management. As such, it deals with three relations: the householder as husband, the householder as father, and the householder as master of slaves and other properties. We will use the latter, that is, the relation with

properties, for our analysis. In this respect, Aristotle used the term *oikonomiké* to refer to all matters related to the use of wealth in order to live and achieve a *good life*, which was Aristotle's ethical ideal.

Aristotle defined *oikonomiké* in close relation with chrematistics (*chrematistiké*). The latter is the art of acquiring or producing the goods used by *oikonomiké*. For Aristotle, chrematistics is subordinated to *oikonomiké*, since he considers chrematistics to be the instrument of *oikonomiké* (*Politics* I, 10, 1258a 27-34). However, chrematistics is not only an instrument of *oikonomiké*, but also of politics, because property is an essential condition of the household and the civil community. Thus, when we consider *oikonomiké* and chrematistics together, we realize that Aristotle's concept of *oikonomiké* goes beyond household management, as many economic historians claim. He maintained that chrematistics and *oikonomiké* are necessary not only for the house but also for the *polis*: chrematistics "is a form of acquisition which the manager of a household must either find ready to hand, or himself provide and arrange, because it ensures a supply of objects, necessary for life and useful to the association of the polis or the household" (*Politics* I, 8, 1256b 26-30; cf. also I, 10, 1258a 19-21; I, 11, 1259a 33-6).

*Oikonomiké* is an adjective and as such it calls for a noun: 'the economic' what? The answer is multiple: 'the economic' applies to several things and not univocally. Using Aristotle's terminology, we may say that it is a homonymous *pròs hén* term, that is, an analogical term. It has a main or "focal" meaning and other 'derivative' meanings; these different meanings correspond to different entities to which the adjective applies. The focal meaning is economic action, which is Aristotle's definition of *oikonomiké*. As explained, he established this definition by comparing it to *chrematistiké*. *Oikonomiké* is the use (*chresasthai*) of wealth, while *chrematistiké* is the provision, production or acquisition of it. "To use" is a human action. Thus, Aristotle understands economic as a human action: the action of using wealth. The derivative meanings of *oikonomiké* are economic capacity, economic habit and economic science (economics), all of which are oriented towards a suitable use of wealth.

Given that 'the economic' as habit entails a moral action, it needs virtues to facilitate its performing. This is why *oikonomiké* has also to be a virtue, economic prudence. Actually, however, there is a constellation of virtues helping to perform suitable economic actions. I will analyse some of them.

First, *oikonomiké* needs temperance. "How can the ruler rule properly, or the subject be properly ruled, unless they are both temperate and just (*sóphron kai díkaios*)?", asks Aristotle (*Politics* I, 13, 1259b 39-40). He distinguished between two kinds of chrematistics: one subordinated to *oikonomiké*, limited and natural, and the unnatural other, not subordinated to *oikonomiké*. Both forms of chrematistics use money as an instrument. Now, the instrument and the means are frequently confused, due to their unlimited (*ápeiron*) desire (*epithumías*), and thus they want money unlimitedly (cf. *Politics* I, 8, 1258a 1). This mistaken view of chrematistics contaminates other behaviours, leading to the use of capacities non-aligned with its nature.

The proper function of courage, for example, is not to produce money but to give confidence. The same is true of military and medical ability: neither has the function of producing money: the one has the function of producing victory, and



the other that of producing health. But those of whom we are speaking turn all such capacities into forms of the art of acquisition, as though to make money were the one aim and everything else must contribute to that aim (*Politics* I, 9, 1258a 6-14).

This sounds like a true modern-day perspective. The cure for endless appetite lies in virtue, more concretely, in temperance.

Second, *oikonomiké* also needs prudence and justice. Let us offer an example provided by Aristotle. In his *Nicomachean Ethics* (V, 5), he analysed economic exchange. He concluded that the tenet ruling demand, and therefore prices and wages, is *chreia*, which means economic need. *Chreia* is subjective and intrinsically moral. It is subjective, because each person judges what is necessary for him or her. There is another Greek term for necessity, *anagke*, also used by Aristotle in other contexts. *Anagke* is strict necessity (as, for example, it is necessary that an effect has one or more causes). But *chreia* is relative necessity: in order to survive, it is necessary to eat, but one may eat one thing or another, according to any timetable, and so on. With regard to *oikonomiké*, *chreia* means that the way of satisfying our needs is not determined *a priori*, but it is up to each one's will, with an eye on the end to be achieved.

In his account of justice (*Nicomachean Ethics* V), Aristotle dealt with economic exchange through the use of practical reasoning. What virtues are needed in the economic process? First, prudence or practical wisdom – an intellectual and ethical virtue – in order to accurately assess the real situation and the real necessity of the things demanded: the suitable *chreia*. Second, justice which helps to act in the way prudence indicates. If justice were to prevail in market relationships, there would be no commercial vices. People who are strongly committed to justice do not free-ride.

Virtues foster the economic process in other ways. Aristotle devoted the largest part of his *Nicomachean Ethics* (Books VIII and IX) to friendship. This virtue, the core source of social cohesion, supplements justice. In fact, between friends, there is no need for justice. Liberality or generosity (Book IV, 1) also help overcome the problem of disequilibrium, through individual or collective action. In sum, in an imperfect world, virtues help reduce error and act as a balm. They foster coordination and reduce problems during coordination adjustments.

I strongly support the Aristotelian idea that we must concern ourselves more with promoting the development of personal virtues rather than with creating perfect systems. Introducing virtue ethics into economic actions is the best policy. This lesson calls for a greater stress on education in virtues and on observance of the law, which constitute the two Aristotelian means of fostering virtues. They should be an important aspect of economic policy, in tune with a truly Aristotelian spirit. If technology consumers and producers were to practice the virtues of temperance, prudence and justice, friendship and generosity, they would counteract the economic disadvantages of the algorithmic society.

## 8. Conclusion

We stand on the threshold of a new world, a new life, a new relationship with technology. Technological progress has advantages and disadvantages. The challenge

lies in managing modern technology in order to make it better serve the human and social good. As Vallor states, “naïve technophilia and reactionary technophobia are equally blind and unthinking responses to technological challenges” (2016: 219). Given the characteristics of this new technology, personal virtue becomes the most adequate and necessary tool to approach technological complexity. Not only technology users must develop virtue but also engineers and businesspersons must be ethics experts committed to virtue. They should not focus themselves on their own specific tasks but rather be aware of the entire process and keep a critical eye on it. As Vallor warns (2016: 244),

This will not be easy, since the lion’s share of the planet’s technological and scientific resources are controlled by liberal societies operating in cultures focused on short-term private gains, alienated from any shared conception of the ultimate moral goods to be realized by collective action in the long-term interests of the human family. Even the notion that there are such goods—as opposed to the immediate, subjective, and often arbitrary preferences of private individuals—is no longer readily granted in many such cultures.

An Aristotelian-inspired practice of economic decisions and actions would thus be an antidote to short-term driven economic behaviour.

We may conclude that teaching correct and virtuous attitudes towards technique from a young age is a most urgent mission today. The new generations will definitively need it. Vallor emphatically expresses this need in the last pages of her book (2016: 245): “*This book recommends a classical solution: an energetic (perhaps even desperate) collective effort to reinvest our cultures in the habits of moral self-cultivation and education for technomoral wisdom.*”

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